In This Issue "A Constructive Public Policy for Utility Growth" with Departmental Discussions of Vital Interest to the Engineers throughout the West

JOURNAL OF ELECTRICITY

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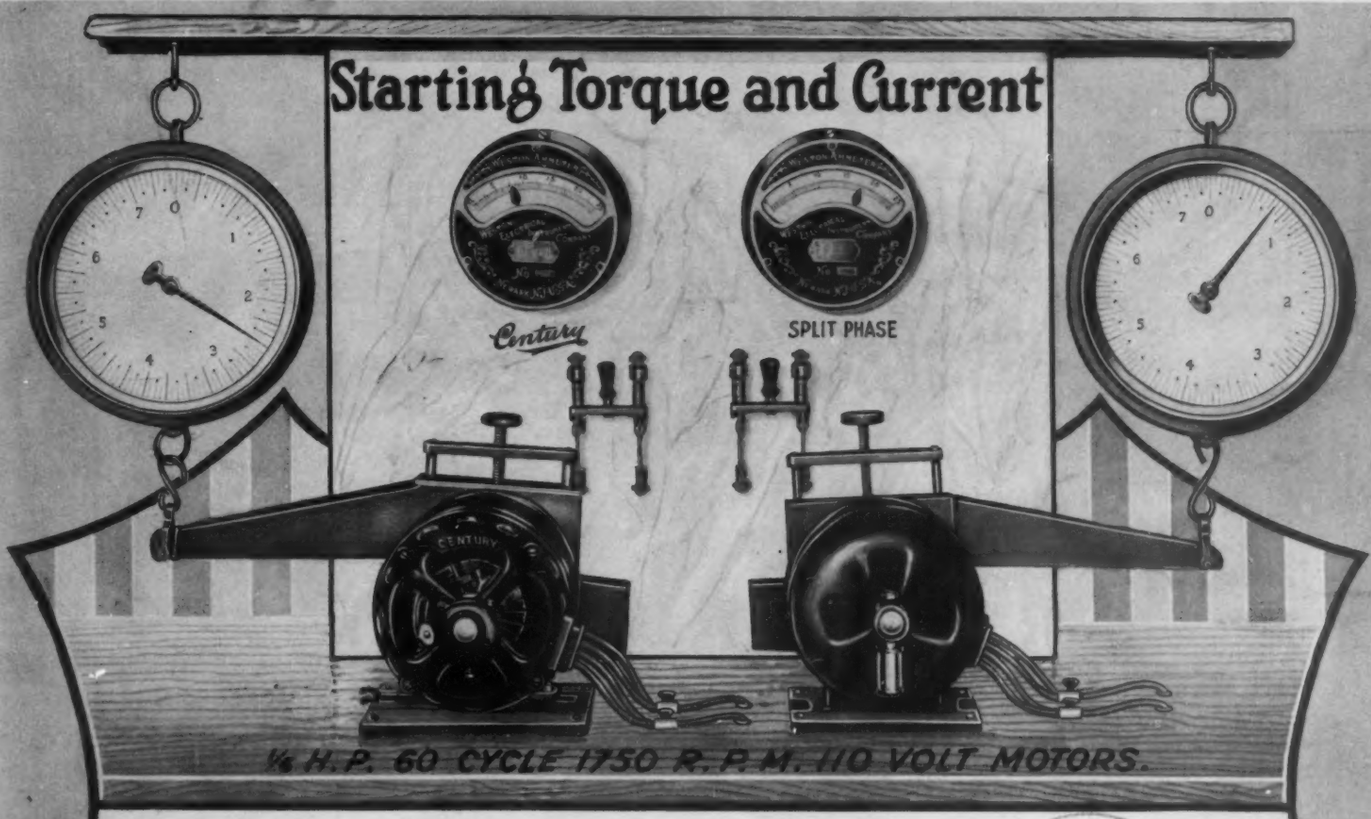

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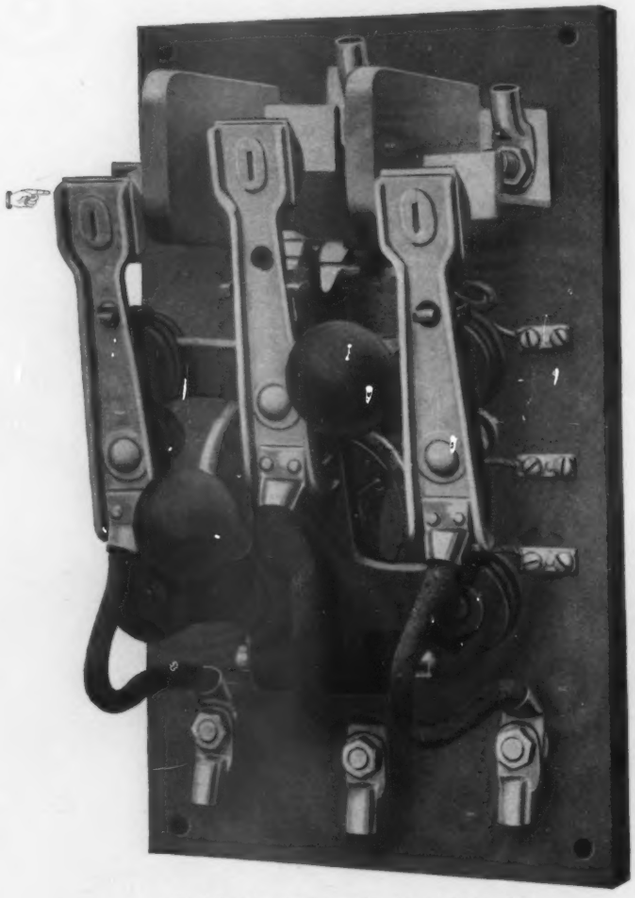

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JOURNAL OF ELECTRICITY

Devoted to the Generation, Distribution and Utilization of Energy

VOLUME XXXVIII SAN FRANCISCO, MAY 1, 1917 NUMBER 9

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UNUSUAL DETAILS IN POWER HOUSE INSTALLATION

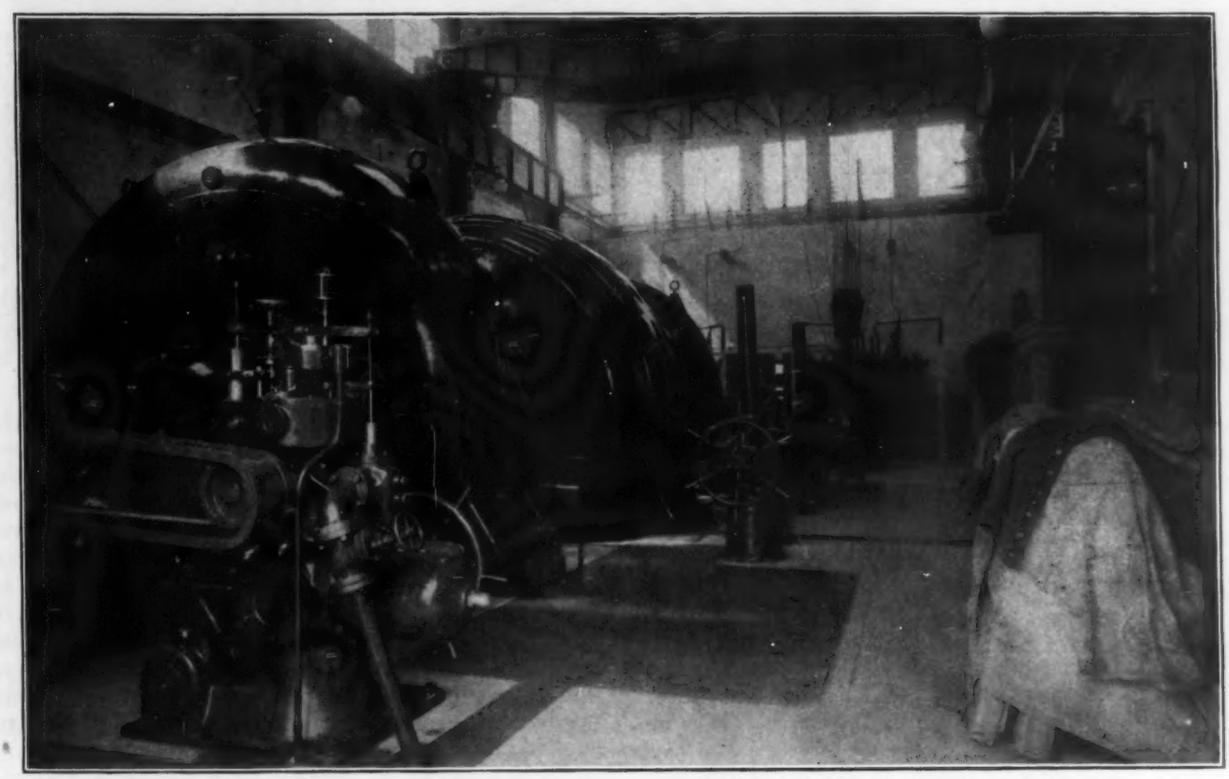
BY J. P. JOLLYMAN

(Details of design, construction and operation of intense interest to engineers of the West have been encountered to an unusual degree in the installation of the Halsey and Wise Power Houses recently put into service upon the transmission lines of the Pacific Gas & Electric Company. As certain physical features of these plants represent new records in hydroelectric accomplishment, the following discussion by the author, who was the engineer in charge of electric construction for this task, should command the attention of hydroelectric engineers the country over.—The Editor.)

Design

Some of the most interesting features of design of the Halsey and Wise power houses of the Pacific Gas & Electric Company are due to the fact that each contains but a single generating unit. In plants of this type it is possible to arrange the apparatus in such a manner that the cubic feet of building required for each kilowatt of capacity will be a minimum. As is seen by an examination of the interior view of Halsey power house, shown herewith, the generating unit is set with its shaft parallel with the long axis of the building and the transformers are set in a pit across the building but under the crane. The 125,000 volt switch room is immediately behind the transformers. The crane does not travel over this room.

With this arrangement, the crane was set 6 ft. lower than would have been possible with the transformers standing on the main floor, and the proportions of the building from an architectural point of view were much improved.



Interior View of Halsey Power House, showing Installation of Twin Wheels on One Shaft With Single Generator Unit Between Them

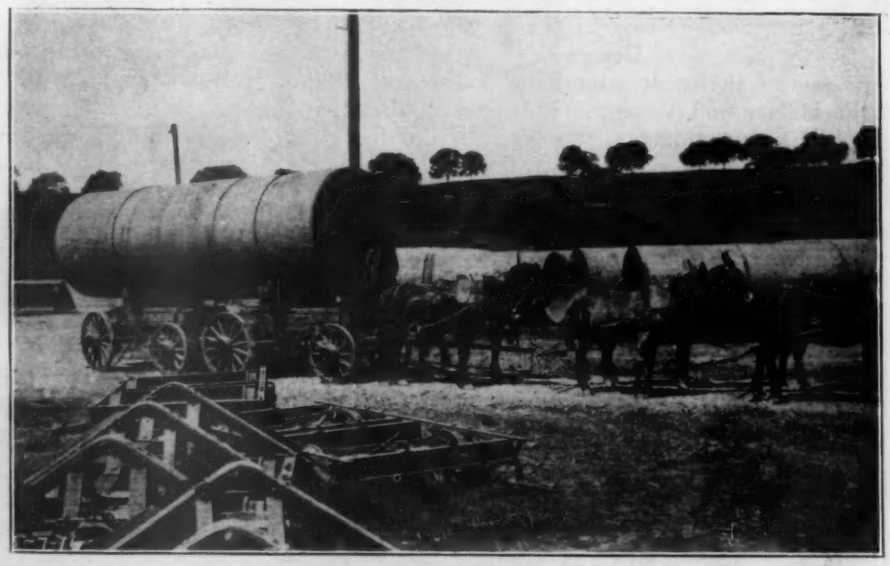
From an operating standpoint the most important feature of design is the fact that there is only one floor. This is made possible by the use of the horizontal shaft type of Francis turbine and a horizontal

generator. With all apparatus on one floor, the operation of the plant is very simple and can be accomplished with a minimum number of attendants.

The interior arrangement of Wise power house is the same as that of Halsey with minor modifications due to the use of one single discharge turbine in place of the two single discharge turbines.

The clearances between the runner and the stationary parts of a Francis turbine for high heads must be very small to secure high efficiency. These clearances at Halsey and Wise were in some cases as little as .006 inch.

The generators were not provided with bed plates for the common support of armatures and bearings. To provide for the support of the two armature sole plates, the two generator bearing sole plates, and the turbine, in such a manner that neither the .87 inch air gap of the generator nor the much smaller clearances in the turbine would be disturbed by any stresses due to operation nor by any settling of the foundations was an important problem. Even though the foundation at each plant was excavated in bed rock it was decided to lay down a concrete pad 3 ft. 8 in. thick and well reinforced, top and bottom, under the complete unit. On this pad were built up piers and walls to carry the sole plates for the armature bearings and turbine. This entire structure was built at one time up to the sole plates and allowed to set before any machinery was placed on it.



Method of Transporting Penstock Piping

Methods of Construction

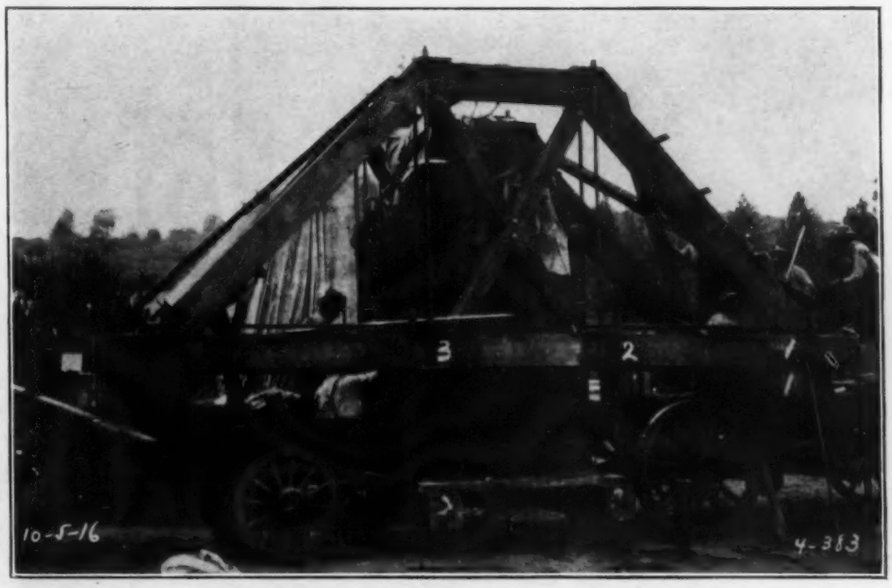
In the construction of such plants as these a number of interesting problems arise and a brief account of the solution of some of them may be of interest.

Halsey is about two miles from the nearest railroad station and Wise a little over one mile. All of the equipment had to be hauled together with the riveted steel parts of the penstock lines. For hauling the 24 ft. sections of the penstocks, some of which weighed 7 tons, use was made of two 4-wheel wagons with the load bridging from one wagon to the other, as shown in the illustration. This scheme proved very successful as the load per wheel was not excessive and the wagons rolled easily on the dirt roads. The parts of the machinery were hauled in the same manner, a platform bridging the two wagons being used where necessary.

The cores of the 4250 k.v.a. 6600 to 125,000 volt transformers were shipped standing upright while the tanks were too tall to be shipped standing. To haul the transformer cores standing vertically and loaded on top of a double wagon would make too high a load for safety nor could the cores be turned on their sides with safety to the windings. To overcome these difficulties two trusses about 22 ft. long were constructed with their ends resting on bolsters on either wagon and with the transformer core suspended between the trusses as shown. The transformer core was placed on two transverse skids which were suspended just clear of the road and were arranged to come down on the road in case of accident to either wagon. That the rig would work as planned was proven on one trip when the wheels of the rear wagon sank into a fill on a turn and the transformer settled down on the ground without damage.

The rotors of the 12,500 kw., 6600-volt, 3-phase, 60-cycle, 360 r.p.m Westinghouse generators are built up with 20 2-in. steel plates each bored for a fit on the shaft and dovetailed for the 20 poles. Now the bore of a disc subject to centrifugal force tends to enlarge, hence a rotor constructed of discs must have a very tight fit on its shaft or the rotor may become loose on the shaft when running at high speeds. The shafts were 26 in. diameter at the hub and the rotors were designed to be bored .008 in. small. This is an extremely heavy press fit, so heavy in fact that it is doubtful if the rotors could be pressed on without damaging the surfaces in contact even though the fit is in four steps. One of the rotors was heated with gas flames and shrunk on its shaft in the factory for the purpose of making efficiency and overspeed tests. When shipment was made the shaft was removed. Upon arrival, the bore of the rotor was found to be about .017 in. smaller than the shaft and the bores of two of the plates were out of round nearly .030 in. These discrepancies were undoubtedly due to pressing the rotor off its shaft in the factory. The Westinghouse Company who supplied the generator, decided to true up the bore before putting the rotor on the shaft. The rotor was placed on its side with the bore vertical and a boring bar carrying a motor driven grinding wheel was mounted through the bore.

The bore was then ground out to .012 in. smaller than the shaft. The boring bar was removed, a box built around the hub and steam coils were fitted inside the box. The rotor was then heated to 135° C. which took about 36 hours and which caused the bore to expand about .033 in. The shaft was suspended from one end on the crane and lowered into the rotor. Compared with trying to press the rotor onto the shaft this plan is very much simpler and leaves the surfaces in contact in much better condition. The bore of the other rotor, which had never been assembled was found in good condition and no re-boring was done even though the bore was nearly .015 in. smaller than the shaft. This rotor was heated in a tank of water brought slowly to a boil and held there until the rotor measured nearly 100° C. As this work was done in summer the shaft was about 27° C. and it was thought the difference in temperature would hardly be sufficient, so the shaft was cooled to nearly 0° C. with a freezing mixture of salt and ice. In this case the rotor was lowered over the shaft. In view of the greater difference in temperature obtainable, the first described method is believed preferable. Further interesting details of this detail in construction may be found in the issue of the Journal of Electricity for Sept. 30, 1916.



Transfotmer Loaded for Transit Over Mountain Road

The two generator bearings were set in place and very carefully leveled. The lower half of the generator armature was set in its pit and the shaft carrying the hub of the rotor put in the bearings. All but two of the field poles were mounted on the rotor and the upper half of the armature put in place. Using the space of the two field poles which had thus been left off the armature coils at the joints of the armature were next placed and then the two last field poles put on. The turbine runners were then put on the overhanging ends of the shaft.

After all of the revolving element had been assembled the main bearings were scraped to a final fit. Since even the most rigid shaft will sag a little under load it is quite important to have all the weight on the shaft before the final scraping of the bearings.

The turbines were then assembled and set with the required clearances between the stationary parts and the revolving parts. Each turbine is provided with a small tail shaft which is bolted to the end of the generator shaft and which extends out through the draft elbow to a small thrust bearing. These thrust bearings limit the end play of the runners and prevent them from scraping the rings in the crown plates of the turbines. To check the settings of the thrust bearings the rotor was turned over with the crane while the shaft was jacked endwise alternately in each direction. The clearances were measured with thickness gauges.

The Allis-Chalmers Company provided sufficient axial clearance in the Halsey turbines to care for .060 in. longitudinal expansion of the main shaft from heating in the bearings. The Pelton Water Wheel Company did not have to provide for such expansion on their turbine at Wise as they had only one end of the shaft to consider.

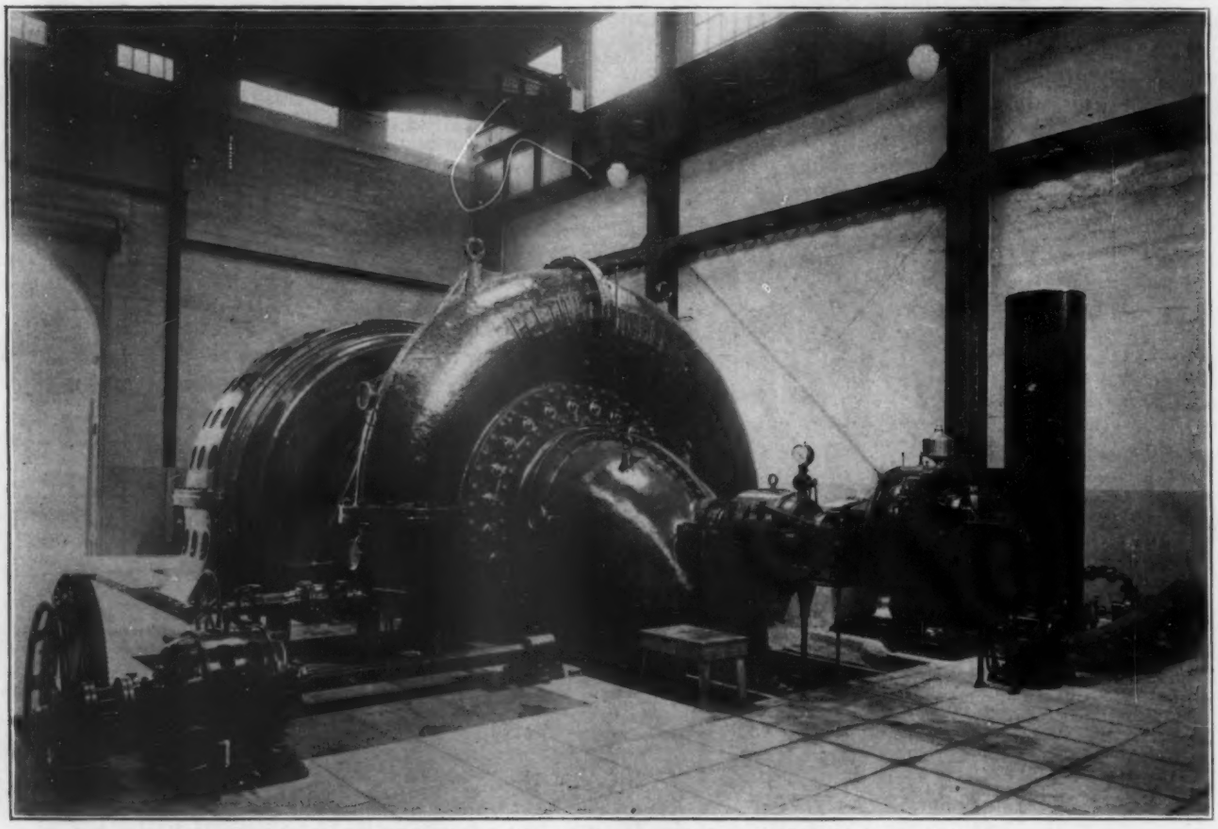
After the turbines were set and concreted into place the final sections of the penstocks and draft tubes were put into place, drilled and riveted. This method of making the final pipe connections eliminates any initial stresses in either pipe or machinery from lack of absolute alignment of the parts connected.

The 4250 k.v.a. Allis-Chalmers transformers were very carefully dried before being filled with oil and put into service. This drying was accomplished by heating the windings to about 85° C. in the tanks with steam in the water coils and by maintaining a vacuum of about 20 in. within the tanks. To maintain a more uniform temperature throughout the tanks, they were jacketed with several layers of building paper spaced apart with wood strips. The dryness of the insulation was judged from megger readings taken from each winding to ground, also between windings. As the windings heat up, the megger readings drop from about 200 megohms to about 100 megohms, then gradually rise to about 2000 megohms at which point they are considered dry. This drying requires from 5 days to 13 days per transformer, depending on its initial condition. While still hot, the transformers were filled with oil which had been dried in a filter press.

Operation

However carefully such large units may be assembled even greater care must be exercised when the unit is first started up. In fact several days are usually required from the first turn-over to prepare the unit for regular service.

First the main bearings must be worked in by many hours of running at reduced speeds. Even with the most careful scraping some high spots will remain and these must be given time to smooth down before the bearing is run at full speed or they will heat excessively and may burn. Then the generator armature windings must be dried out by 36 to 48 hours of running on short circuit with sufficient field current to give full load armature current or more. The condition of the armature insulation is judged by the megger and was, for these generators, brought up to about 10 megohms at 80° C.



Interior View of Wise Power House, showing Mammoth Single Discharge Unit

After the unit is dry and up to speed the voltage is built up very slowly and the machine carefully watched for any smell of ozone which would indicate a lack of sufficient dryness. Next the transformers are built up to voltage with the generator, then they are switched off the generator and into the system with which the plant is to run in parallel. The electrical rotation of the generator is then compared with that of the system and if found correct the unit may be paralleled with the incoming line.

Synchronizing the plant with the system for the first time is an event of much interest marking as it does the formal completion of the plant. Accounts of the ceremonies at Wise were given in the Journal of March 15, 1917.

Turbines operating at the ends of long penstocks must be equipped with relief valves or their gates cannot be closed quickly without causing water hammer in the penstocks.

The Halsey penstock is 5418 ft. long and the Wise penstock is 8546 ft. long. The stored energy in the latter is about 35,000,000 ft. pounds for a flow of 400 second feet which is full load. Obviously this energy must be absorbed slowly or a very great pressure rise would result. 8The turbines in both plants are equipped with governor operated relief valves which open as the turbines close and then close at a rate determined by a dashpot which can be set for any desired closing time. A closing time of about 1½ minutes was found sufficient for both the Halsey and Wise penstocks.

To avoid excessive rise in speed on sudden loss of load the closing time of the turbine gates should not exceed 3 to 4 seconds. The relief valves must open in this same time and in such a manner that the rate of flow of the water in the penstock will not be materially changed.

The final tests on the plants consist in pulling up loads of gradually increasing amounts and then separating from the system by opening the generator switch. As the speed starts to rise the governor starts to close the turbine gates and to open the relief valve. Some disturbance in the penstock pressure is inevitable so the pressure gauges are watched and the relief valves readjusted before another test is made if the results are not satisfactory. Loads as high as 9200 kw. were dropped instantly on these tests with a pressure rise of only 11 per cent above the static pressure.

One of the most interesting things that happened during the starting of the plants was the permanent lengthening of the generator shaft by about .035 in. This occurred during the first hour of operating and is believed to be due to the shaft relieving itself under the influence of the alternate bending stresses of some of the great compressive stress set up in the shaft by shrinking on the generator rotor

CONSTRUCTIVE PUBLIC POLICY FOR UTILTY GROWTH

BY JOHN A. BRITTON, Chairman

(Constructive public policy on the part of utility managers throughout the West proved to be the keynote of thought and discussion at the recent gathering of electrical men at Riverside. It is almost with profound reverence that the following beautiful and masterly composition is set before our readers. Composed of a public policy committee consisting of John A. Britton, chairman, Pacific Gas & Electric Company, San Francisco; W. A. Brackenridge, Southern California Edison Company, Los Angeles; H. H. Jones, San Diego Consolidated Gas & Electric Company, San Diego; S. M. Kennedy, Southern California Edison Company, Los Angeles; A. G. Wishon, San Joaquin Light & Power Company, Fresno, this remarkable document was delivered at the first annual convention of the Pacific Coast Section of N. E. L. A., April 19-21, 1917. Coming as it did at a time of unprecedented world stress, as the venerable chairman proceeded in reading the concluding remarks in his report, each listener involuntarily raised himself higher in stature and pledged again loyalty to his God, his country and himself.—The Editor.)

Your public policy committee approaches, with very considerable pleasure, its initial recommendations to the geographic section; for the section has, by reason of its peculiar geographical situation, and because of necessity of its initiative, had to confront more intricate problems and settle them in its own way than has any other section of the United States. This not only relates to its operative conditions, but its political as well.

Of most importance to the companies constituting the geographic section, it seems to your committee that inter-company relations stand out significantly. In most of the other states a consolidation of interests is provocative of a unity of relation and a mutual defense against attacks, however made, and a unity of interest in protection also of rights, and in an avoidance of precedents being established before the courts, the railroad commissions, and legislatures.

It is recommended to this section that through the executive officers a plan be outlined by which no member of the association will take up initiatively any matters before court, commissions or legislatures, wherbey a precedent would be established, without the consent of either the executive committee or of the public policy committee.

Much closer inter-company relations would be of material assistance to any member company, when presenting a case before a court or railroad commission; and would enable the member company to eliminate testimony which might be contradictory, and to bring out all the essential points, so that the company's contention might be placed before the court or commission in the most forceful manner possible.

Next in importance is the attitude of public utility companies as concerns their relations with the railroad commissions. Prior to the institution of regulation by commissions, conditions were such as might be expected from a freedom of operation; and because these conditions have been removed the public utility companies are grateful, and look to a protection from regulation, that eventually is bound to prove beneficial. Regulation has by elimination of public utility companies from the domain of politics accomplished a needed reform.

Rate fixing, as determined by companies on their own initiative, consisted of a hodge-podge of uncertainties, and the novices in the game had a better chance of being heard than experts. Rate making is a science of which but little is known, and of which we have much to learn; and by and with the advice of the railroad commission we are gradually being educated to a method of rates for service which stand for stability and uniformity and the protection of investments.

There can be no question that public utility securities under regulation have become more stable, taking on much of the standing that city, county, state and national securities possess.

It is certainly to be hoped that some day the general public, now falsely educated by the press generally in the matter of municipal ownership, will consent that the powers of the commission of this and other states include municipally controlled utilities to the fullest extent. Less fear would be entertained of municipalities engaging in the public utility business if the truth in regard to those already established were fully known. This will never be known so long as their methods of operation are controlled by a few office-holders. This section should work toward the end of educating, in every way, the public to the realization that privately-owned utilities should be treated fairly, and its action should not be handicapped by a competitor who can do the very things which are forbidden under regulation to the public utilities privately owned.

We recommend that all public utilities be honest, fair, frank and open in all of their dealings with the commissions of the several states, so that absolute confidence will prevail in the minds, not only of the commission itself, but of its subordinates. Strict compliance, therefore, with all requests of commissions is enjoined in a frank exposition of any position in which a utility may find itself by reason of commission needs.

It may truly be said, in support of the often-enunciated principle by state commissions, that regulated monopoly is more effective than competition in giving better service to the public. Your committee, however, is of the opinion that public service will never be given as satisfactorily when controlled municipally as it will be when operated and given by a privately owned corporation, because of the greater stability of the organization of the privately owned utility.

There is a constantly recurring feeling among companies and their employes now under regulation that the old-time incentive to economical administration, and consequent betterment to both employer and employe, does not now exist; that improvements to either apparatus or conditions of operation are taken away in their effectiveness by the general determination of the commissions to allot only a certain return

on capital. It would seem desirable that commissions should as soon as possible announce a policy in this regard.

Taxation has become something of a problem in this and other states, and while in California the departure from the ad valorem method of taxation was deemed to be a proper solution, the constantly increasing percentage of the gross revenue brings up the question as to whether or not it has solved the problem of taxation. The finding of the State Tax Commission that the assessed value of corporations, estimated either on the ad valorem basis or on the bond and stock basis, was not on a par with the assessed value of other properties of the state, reveals a weakness in the methods of determination of value. It was recommended by the Tax Commission of the State of California that the rate be raised from 5.25 per cent to 5.60 per cent of our gross. As the exigencies of the state continue, we feel that there should be a limitation to the percentage amount that may be required of the gross. It is a correct assumption that this burden must fall upon the rate payer, for it is included in the operating expense of corporations; and therefore it must be absorbed in increased rates for service, and must be considered by the railroad commission in fixing rates. Unlike the ordinary seller of products, however, a public utility cannot from day to day or month to month increase its rates as its burdens increase; but must maintain the rate fixed, no matter how heavy the burdens are, until commissions in their wisdom, on extended hearings, determine that the rate is burdensome.

In order that there may be a parity between municipally owned and privately owned utilities, your committee is firmly of the opinion that the state should tax municipally owned utilities in the same manner and at the same rate as similar utilities operated by privately owned companies. Common fairness of treatment, and the state's necessities, would seem to dictate this policy. Tax exemption of publicly owned utilities, results in an uneven and unjust distribution of taxes. Municipalities were not the pioneers in any public utility undertaking, but played the waiting game and came in to reap the benefits of the brains and capital of others who have made developments, and it seems manifestly unfair that they should now take advantage of them still further in exemption from the same burdens as the privately owned utilities have to endure.

It is recommended by your committee that exhaustive inquiry be made, by a committee to be appointed, into the question of taxation in all of the states involved in the section, in order that at our next meeting, which shall be prior to the next convening of legislatures, a thorough understanding of this question may be had, and that the companies interested may be prepared to resist any further increase of that particular burden of operation.

Your committee strongly recommends that greater efforts be made through the section for the education of the masses in the knowledge of our industry, either through the agencies of the universities and schools or by public meetings. Familiarity with our institution will provoke favorable notice. The acts of all public utilities should be open and above board and the public should be familiar with its aims and ambitions as well as with its trials and tribulations, and a constant campaign along this line will do more to enlist the good will of the public and secure finally that which we alone desire—the recognition of a just return upon the capital in our hands as trustees devoted to public use.

It is a well-known fact that 95 per cent of the complaints against public utilities originate from an unthoughtful or discourteous act of some subordinate, which would not be tolerated by the managers of the companies, had they knowledge. Each company should endeavor, through a proper agency, to educate its employes in courtesy towards the public—and some officials will bear education in the same line. Promptness in attention to complaints and replying to communications, and the recognition at once of any claim of a customer, just or otherwise, will do more towards strengthening ourselves with the public than any other means we can employ, and the public should be educated to the fact that the companies invite, constantly, any recommendations or criticisms, in order that closer relations be established.

The care of employes should receive our very serious attention. It is desirable that where conditions will permit a general and uniform rule among corporations of our character with respect to the care of the sick, and a certainty by a pension plan of old employes being properly cared for.

Employes should be educated along the line of connecting themselves as stockholders with the companies for which they work, in-so-far as their financial ability will allow. Proper wages and compensation should be paid to employes; and this, if done in a voluntary way, would result in less trouble from labor union agitators.

The recent formation of the highway commission of this state has presented some very serious problems that time alone can work out.

Your committee is of the opinion that it would be advisable for representatives of member companies to discuss with the highways commission some of the conditions to which the commission has at present taken exception. It is probable that an agreement between the companies and the commission for uniform construction, painting of poles and joint occupation of pole lines where possible, would do much to smooth out the wrinkles and eliminate most of the objections which the commission has recently made.

The Pacific Coast states have a tremendous future and prospect, and the expanding industries will require from corporations in our class a large capital expenditure. The railroad commissions, mindful of this fact, have been and will be lenient in permits given for enlargements of capital, as they by that means will be a great factor in the upbuilding of the state; but we must do our share in finding money at the lowest possible price. This can be done by maintenance at all times of economic conditions in our business and by proper spending of the capital obtained produce a diversity in our distribution that will continually help to minimize costs and therefore permit the lowest possible rates to be given for service.

There is one point upon which the commissions must be educated, and that is the question of discrim-

ination. In the development of the business in this state electrically it is important not to consider discrimination in a limited sense, in order that we may obtain the very best results for the company and for the public in general. There are classifications of service that need regular schedules of rates; there are others, such as infant industries, that need protection; also mining developments, uncertain in their initial stages (by mining we also include oil), where fixed schedule of rates applicable to going concerns would be detrimental to the growth of the newer industries, and a certain amount of reasonable discrimination should be allowed. We recognize that there may be wise and just discrimination between different classes of consumers, but that there should be no discrimination between consumers of any particular class.

Regulation in the sense heretofore used will certainly be of no benefit unless it is accompanied with a monopoly. Companies occupying certain territory should not be put under the burden of competition, but should be compelled, at rates under regulation, to serve all of the territory, and it should not be able to excuse itself nor give such service as will compel commissions to permit competition. So long as there is no monopoly under regulation, just so long will it be impossible for companies to reasonably finance themselves for the extension of new business that may be forthcoming. It certainly will have a distinct tendency to scare away the timid investor who fears both competition and regulation.

Where competition does exist and where lines parallel those of the telephone company, due consideration should be given to joint pole agreements. The sparsely settled sections of each state require, in order to develop any particularly new business, long lines that are not remunerative. The joint pole solves this problem to some degree and has proven in certain cases very satisfactory, the electric competing and telephone companies co-operating more and more. The telephone companies would do more if they could be educated out of the notion that a higher voltage on our lines than 4000 is detrimental to their service. In this connection, the inductive interference committee, appointed by the state commission and the power companies jointly with the telephone companies, are working out some of the problems; and it is our belief that a greater amount of co-operation can be later obtained from the telephone companies.

The last few years have shown a marvelous development of the uses of electricity on the farm and generally for agricultural purposes. The education of farmers to the benefits of electricity has been a constant effort on the part of member companies in our section, and the results are viewed with astonishment by eastern companies. It would be interesting to know just what part the use of energy for all purposes of agriculture, including reclamation, irrigation, and power on the farm, both for domestic and other uses, bears to its use for other purposes.

It may be assumed in the present condition by which this country is involved in war that the mind of the public may be taken away to a degree from public ownership, and with the suggestions heretofore made, and with apparent legislation in some states bringing municipally owned utilities under control of the commissions, the development of the onerous burdens placed upon the taxpayers by municipally conducted plants will be brought forcibly to the attention of the taxpayers.

Having in mind the possibilities of a call from the national fiovernment, to the citizens of this nation, for service in the ranks, your committee strongly recommended the adoption of the following resolutions, which on submission at today's session were unanimously adopted:

"Whereas, the safety and welfare of this Nation in times of war, as well as in peace, demands the continuance of transportation and industrial and agricultural pursuits; and

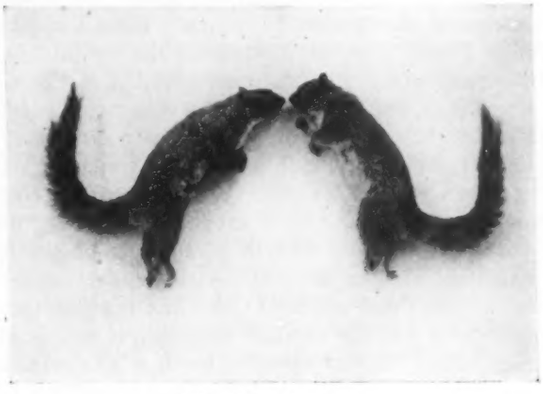
"Whereas, the public utilities of the classes represented here are large factors in the furnishing of energy for transportation, light, heat and power purposes, and particularly in the supply of industrial and irrigation purposes; now, therefore, be it

"Resolved, that we tender the use herewith of our system and service to the government of the United States in protecting it in necessary transportation, manufacture of munitions of war, ship-building, raising of food-stuffs, and other necessities of life.

"Resolved, further, we favor selective conscription, and that a copy of these resolutions be forwarded to the President of the United States and the Governors of Arizona, California, Nevada and New Mexico."

AN INTERESTING SHORT-CIRCUIT PHENOMENON

On patrolling the line of the Boston Edison Company as recounted in the February issue of Edison Life, the trouble man found one of the lines on the ground, with one of the squirrels shown in the cut lying dead beside the wire. The other squirrel was wedged in the crossarm brace on the pole, and was



The Kiss of Death

also dead. On examination, it was found that the bodies and noses of both animals were burned. The nature of the burns disclosed the fact that one squirrel was on the line, and the other was on the brace which is grounded. When the little animals touched noses, a flash over from line to arm was caused, which burnt off the wire and resulted fatally for the unfortunate lovers. Which goes to show that the top of a pole carrying 13,800 volts is a bad place for spooning.

PROBABILITY PAPER FOR DISCHARGE RECORDS

BY FRED F. HENSHAW

(The use of probability paper in the analysis of hydraulic data has been presented by Allen Hazen in the Transactions of the American Society of Civil Engineers, page 1539, 1914, in an article entitled "Storage to be provided in impounding reservoirs." In this excellent article the author, who is district engineer for the U. S. Geological Survey at Portland, Oregon, cites specific instances from data taken on Western streams which should prove very useful to engineers having discharge record tasks ahead of them in the study of stream flow.—The Editor.)

In plotting observations the whole space is divided into as many vertical strips as there are terms, and the figure for each term arranged in order of its magnitude is plotted at the percentage that corresponds to the middle of its strip; that is to say, if there are 50 terms in the series each is taken to represent 2 per cent of the whole space. The first term will be plotted at the middle of the first 2 per cent strip on the 1 per cent line; the second term will be plotted in the middle of the second strip, or on the 3 per cent line. If the data for any series correspond strictly with the normal law of error, the points plotted on this paper will define a straight line. If the data approximate the normal law of error the line through the points will approximate a straight line. Even though the deviation from the normal law of error be considerable a line with only a moderate curvature may represent it fairly well. Regardless of the number of observations in the series, 10 per cent of them will fall to the left of the 10 per cent line, and 20 per cent to the left of the 20 per cent line. Therefore the line may be used to determine the probable percentage of years in which a flood of given magnitude will be exceeded or for which the minimum discharge may be less than a given value.

To illustrate the application of probability paper to studies of flood discharge, maximum flood discharges have been plotted for Columbia, McKenzie, and Deschutes rivers. For Columbia River the record of maximum floods covers 58 years. Thus the year of highest flood, 1894, is plotted in the middle of the strip representing 1.73 per cent or 1/58 of the whole time; that is, on the .86 per cent line; the year second in height of flood, on the 2.59 per cent line, and so on. The straight line is drawn averaging all the points thus plotted. If the series of records covered a long enough period it is assumed that they would all plot on this line. It will be noted that the mean line passes considerably below and to the left of the point for the flood of 1894. The line reaches the discharge value for this flood at the point at which would be plotted the highest observation if a 500-year series were available. It may be accordingly concluded that in so far as this method of reasoning holds true the recurrence of a flood equal to that of 1894 may be expected only once in 500 years. For the McKenzie we have records covering 10 years, and the observations define a curve fairly well. For the Deschutes the points lie on a much flatter curve than that for the McKenzie, as might be expected of a river of its remarkably uniform regimen. The flood of 1909, however, is way off the curve, and a flood of this magnitude appears to be reasonably expected hardly once in 1000 years.

The values of total yearly run-off have been plotted in a similar manner for three streams—Sacramento River at Red Bluff, Cal., and Powder and Deschutes rivers in Oregon—and minima have been plotted for Columbia, Deschutes and North Umpqua rivers, Oregon. The degree of regularity of flow of a stream, year by year, may be measured by the percentage of variation that may be expected, say, one year in ten. It is found by expressing the value intercepted by the probability curve on the 5 per cent or 95 per cent line in terms of its variation from the value at the 50 per cent or median line.

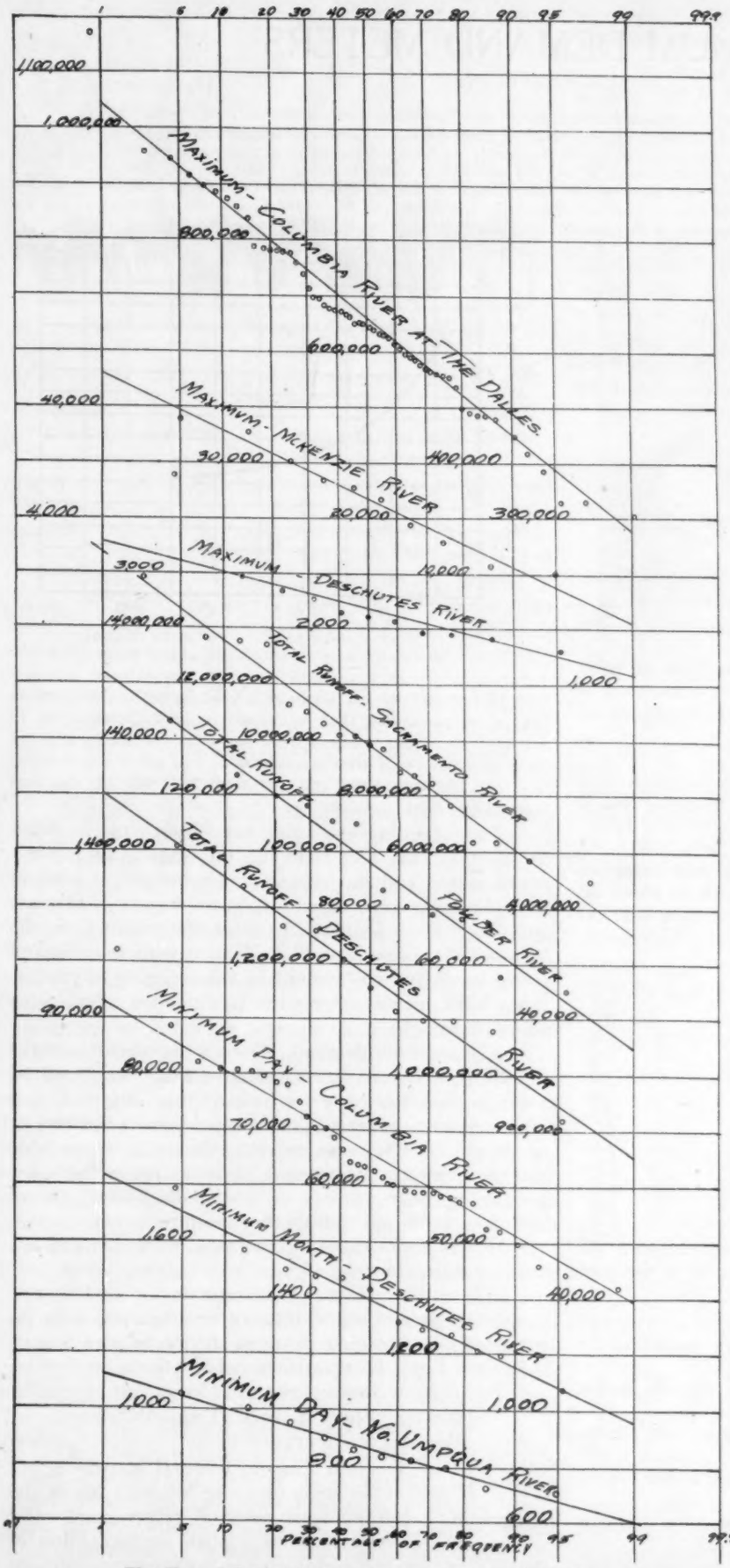
The total run-off of the Sacramento shows a variation on the 5 per cent and 95 per cent lines of ± 49 per cent, that of the Powder, ± 50 per cent, and that of the Deschutes ± 19 per cent; that is, in the case of the first two streams the total annual run-off one year in ten may be expected to be 50 per cent below, and one year in ten 50 per cent above the average. But on the Deschutes the year of highest or lowest run-off may be expected to vary from the average less than 20 per cent one year in ten.

The minimum mean for the Columbia is about 66,000 second-feet, the lowest recorded value 41,600, the value on the 95 per cent line, 47,000, and the coefficient ± 29 per cent; for the Deschutes the mean is 1400 second-feet, the year of lowest annual run-off in ten, 1090 second-feet, the coefficient ± 23 per cent; for the North Umpqua the coefficient is ± 21 per cent. The Deschutes and the North Umpqua are almost wholly spring-fed at low water, which in great measure accounts for their regularity.

The accuracy of definition of a probability curve may be tested, like that of any curve, by the deviation of the plotted points from the mean line defined by them. Thus, for the total run-off of Powder River the variation of the plotted points is from + 10 to — 11 per cent; for the Deschutes it is from + 5 to — 5 per cent. The line representing the probable future regimen is much better defined for the Deschutes than for the Powder. For minimum flow the maximum deviations for the Columbia are + 11 and — 6 per cent and for the North Umpqua, + 3 and — 4 per cent.

The deviations for any 10-year record on Columbia River would be greater than for the 38-year record used. In general, the degree of the curve of probable occurrence varies inversely with the coefficient of variation and directly with the number of years of record.

The engineer making a study of any hydraulic problem involving the utilization of the water of a stream has on the one hand the discharge records, and on the other certain facts and assumptions as to the probable use of water. With probability paper its analysis becomes much simplified.



The Use of Probability Paper for Discharge Records

CHEMICAL ACTION OF WATER ON OIL

Work in the California oil fields by the United States Geological Survey of the Department of the Interior has developed some interesting facts which will doubtless be of considerable benefit to the oil industry.

The progressive alteration of the water as oil is approached is so constant and so striking in the area examined that the conclusion that the oil and water have reacted chemically can not be avoided. It was suggested long ago in the Russian oil fields that hydrocarbons are able to reduce sulphate to sulphide, and that they themselves are simultaneously oxidized to carbon dioxide or carbonate.

Some of the sulphide formed in the reaction between the hydrocarbons and the sulphate waters is undoubtedly oxidized to sulphur. Some of this sulphur is taken up again by the oil, which makes the oil heaavier and more asphaltic. In the oil fields of San Joaquin Valley the oil that has been most exposed to the action of the water generally contains the most sulphur and is of the highest gravity. It seems probable that the natural gas is also affected by these reactions, and that some of the carbon dioxide formed is not taken up by the waters but mixes with the gas and thus lowers its heating value. The gas nearest the outcrop of the oil sands, where sulphate water can most readily enter the strata and where the reaction would most naturally be most vigorous, may contain as much as 35 per cent of carbon dioxide.

A preliminary report on California oil-field waters, containing a number of analyses and a discussion of the principles that control the chemical variations in the waters, has just been issued by the United States Geological Survey as Bulletin 653, entitled "Chemical relations of the oil-field waters in San Joaquin Valley, California," by G. Sherburne Rogers. This report also points out how the principles set forth may probably be put to practical use by oil operators. A copy of the report may be obtained on application to the Director of the U. S. Geological Survey, Washington, D. C.

MAXIMUM DEMAND METERS

BY W. A. HILLEBRAND

(The use and development of the demand meter due to peculiarities of central station load throughout the West is a subject that is receiving an immeuse impetus among central station engineers and regulating bodies alike. Here is an excellent article that deals with the treatment of the demand meter in an exhaustive manner. In its completeness it will appear in three separate issues of the Journal. The author is a well-known investigator and authority on central station use of demand meters and is with the engineering staff of the Pacific Gas & Electric Company. He delivered this paper before the recent meeting of the San Francisco Section of the American Institute of Electrical Engineers.—The Editor.)

An increasing tendency on the part of central stations and public service commissions to favor a demand and energy rate for service has, within recent years, greatly stimulated the use and development of the maximum demand meter. The importance of the demand element in such a charge is illustrated by the following hypothetical but representative rates:

Rate Number 1

Demand charge of two dollars per month per kilowatt of maximum demand. No energy charge.

In this rate the demand element is one hundred per cent of the total charge.

Table Number 2

Demand charge of two dollars per month per kilowatt of maximum demand, with a minimum bill corresponding to a demand equal to 50 per cent of the connected load in kilowatts.

In this case the consumer's actual demand has no effect upon the charge for service until it exceeds a minimum of half of the connected load. It will rarely be responsible for half of the total bill.

Table Number 3

Demand charge of one dollar per month per kilowatt of maximum demand with a minimum demand of 50 per cent of the connected load.

Energy charge of one cent per kilowatt hour.

The monthly charge for service with this rate, under representative conditions, is indicated in Table 1, in which the demand charge is only that due to the excess over fifty per cent of the connected load.

Table No. 1.

Connected Load, kw.	Demand, kw.	Load Factor, per cent.	Kilowatt Hrs.	Minimum Charge	Demand Charge	Energy Charge	Total Charge	Demand Charge, per cent of total
1.0	.5	25	180	.50	0	1.80	2.30	0
1.0	1.0	5	36	.50	.50	.36	1.36	37
1.0	1.0	15	108	.50	.50	1.08	2.08	24
1.0	1.0	25	180	.50	.50	1.80	2.80	18
1.0	1.0	50	360	.50	.50	3.60	4.60	11
1.0	1.0	80	576	.50	.50	5.76	6.76	7.5

The demand element of a rate such as number 3 will rarely affect the total bill by more than thirty-five per cent.

Rate Number 4

Where the monthly maximum demand is not over 100 kw.:

2.5 cents per kw.-hr for the first 50 kw.-hr per month per kw. of maximum demand.

1.5 cents per kw.-hr. for the next 50 kw.-hr. per month per kw. of maximum demand.

1.0 cents per kw.-hr. for the next 50 kw.-hr. per month per kw. of maximum demand.

.8 cents per kw.-hr. for all over 150 kw.-hr. per month per kw. of maximum demand.

Minimum monthly charge, one dollar per kilowatt for 20 per cent of the connected load.

This rate is designed to favor the consumer with a good load factor, and its variation with load factor is indicated in Fig. 1, which shows that a change in load factor from 10 per cent to 20 per cent, or a 50 per cent change in demand for a given kilowatt hour consumption, will affect the average rate per kilowatt hour and the total monthly bill by less than 23 per cent.

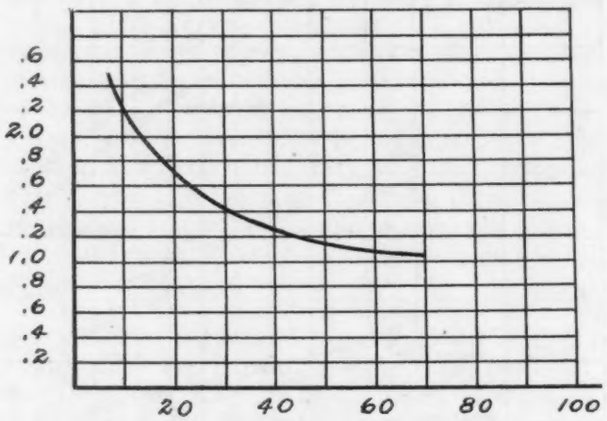


Fig. 1. Curve showing Rate Variation in Cents per kw.-hr. with Load Factor in Per Cent

The foregoing examples have been cited in order to illustrate the fact that the importance of the demand meter and its accuracy of registration will, in any particular case, depend upon the nature of the rate applying. With so much by way of introduction, the balance of this paper will deal only with the demand meter itself, and will consist in a description of various types with comments on their respective advantages and defects.

A maximum demand meter must perform three functions, measure the maximum load in kilowatts, average that load over a definte time interval, and give a permanent and reliable record of its indication. It should be moderate in cost, accurate, dependable and require little attention. So far as the writer's experience goes, no device on the market today more than approximately fulfills these requirements.

Meters for measuring the maximum demand are of three general types:

1. Graphic indicating instruments.

2. An indicating wattmeter or ammeter, with its movement constrained by some device to give a suitable time lag. To this class belong the

Wright demand meter.
General Electric types H and W.
Westinghouse type R O.

The proposed Lincoln thermal wattmeter.

3. A device for recording the kilowatt hours delivered in a definite time interval, either graphically or by some other indication. With the exception of the Wrght demand meter, this is the most popular and

widely used type of instrument. To this class belong the

Graphometer,
Printometer.
Ingalls Relay Demand Indicator.
General Electric types M-2 and M-4.

There are other instruments of this classification which perform the same function but are not mentioned

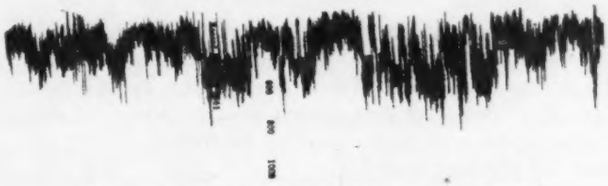


Fig. 2. Record of Fluctuations Due to an Air Compressor

by the writer because he is not familiar with them.

In considering the duty of a maximum demand meter it must be borne in mind that, due to the overload capacity of apparatus, the demand in which the power company is interested is usually not the instantaneous maximum but the demand averaged over a suitable and specified interval, such as five, fifteen or thirty minutes. In some cases the consumer's momentary demand, more than any average, determines the cost of service, but such fact is, so far as the writer knows, commonly disregarded in establishing rates. All the meters herein referred to, except of the graphic indicating type, are designed to give the average maximum demand over a period of at least five minutes.

Graphic Indicating Instruments

A graphic indicating ammeter or wattmeter may be used to measure demand over any desired period the avantage that it gives the load curve and time of consumer's maximum. However, such an instrument is high in first cost, requires constant attention, is not very accurate and is difficult to read. On fluctuating loads the errors due to inertia of moving element are very great, and furthermore, if the fluctuations are very rapid, the ink will either not flow rapidly enough to record or will have a broad band which makes the precise determination of the quantity sought a matter of opinion. Such a record is illustrated in Fig. 2, in which the fluctuation was due to an air compressor.

With a strip chart having a speed of three inches an hour, which is about the minimum for a satisfactory record, one meter will require 180 ft. of chart per month, which must be gone over, the point of average maximum determined by inspection and the area generally integrated with a planimeter.

Some graphic instruments also constitute such a heavy load as to appreciably affect the accuracy of current transformers to which they may be connected.

On the whole, the disadvantages of such a method of determining maximum demand are so great as to eliminate this class of meter except for occasional use.

Lagged Indicating Meters

One distinct class of demand meter uses a heavily damped indicating element that, with a steady load applied, will indicate that load only after the lapse of a considerable period of time. In all meters of this class the time lag is inherent in the design and is not produced by any external device. Three of such meters are illustrated in Fig. 3, the Wright Demand, Westinghouse type R O and General Electric type W.

The characteristic behavior of meters of this class is indicated in Fig. 4, in which the load is assumed to be constant for fifteen minutes, then to double for seven and one-half minutes, at the end of which time it drops to zero. If the time interval of the meter is fifteen minutes it will give an indication that will vary

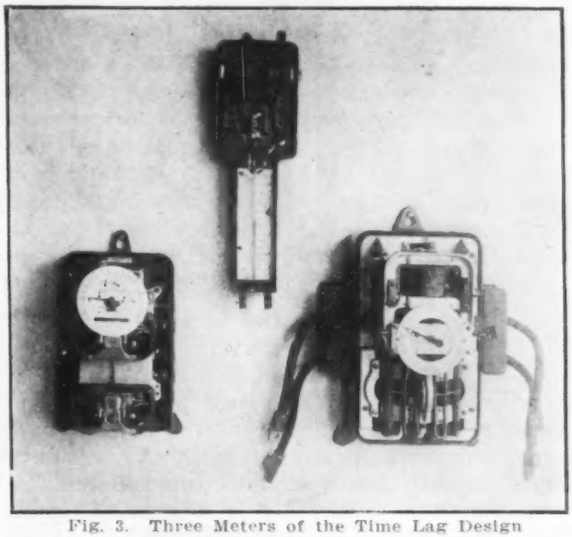


Fig. 3. Three Meters of the Time Lag Design

with the time according to its characteristic curve AB. At the end of fifteen minutes it correctly indicates the load B. If a load equal to Y had been applied at A, the meter would have followed the dotted curve. Now, when the load at B is doubled, the meter records along the curve BC, parallel to and identical with the curve AD, so that when the load finally drops off its indication is some such value as C, whereas the fifteen minute average maximum is a smaller value, E. One recently developed type of meter, with a time interval of fifteen minutes, will record on this load the value D, or 33 1/3 per cent above the average maximum for fifteen minutes.

Wright Demand Meter

Perhaps the earliest and most widely used demand meter is that invented by Wright and which bears his

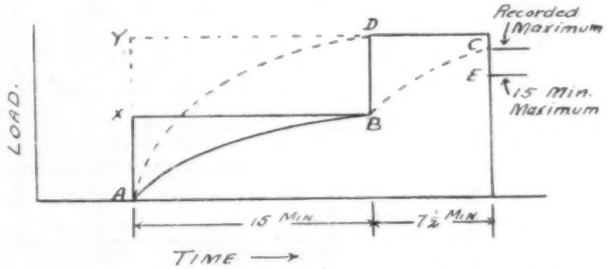


Fig. 4. Typical Performance of Indicating Type of Demand Meter

name, see Fig. 5. It consists of a glass U tube partly filled with a non-freezing liquid such as sulphuric acid. B_1 B_2 are hermetically sealed bulbs containing air, the one on the left hand being enclosed by a heater strip in series with the circuit. When ready for operation the liquid stands at the level of the index tube I. Air confined in the left hand bulb is heated

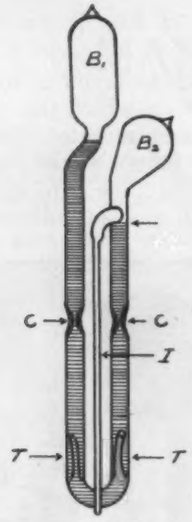


Fig. 5. Principle of the Wright Demand Meter

by the passage of current and in expanding forces liquid into the index tube, where its height as read on a suitably graduated scale indicates the maximum load. After the monthly statement is taken, the instrument is reset by tilting until the index tube is drained. To prevent passage of air from one bulb to the other, capillary constructions are introduced at C and traps at T. A time lag is introduced by the heat capacity of the heater strip, glass, and air.

The characteristic curve of this meter on steady load is shown in Fig. 6. Particular attention is called to the fact that on heavy loads of short duration the indication is largely a function of the capacity of meter that happens to be installed.

The advantages of this meter are simplicity and low cost. Its disadvantages are that it is easily broken in transport; its time interval is short; its indication is proportional only to current and the average

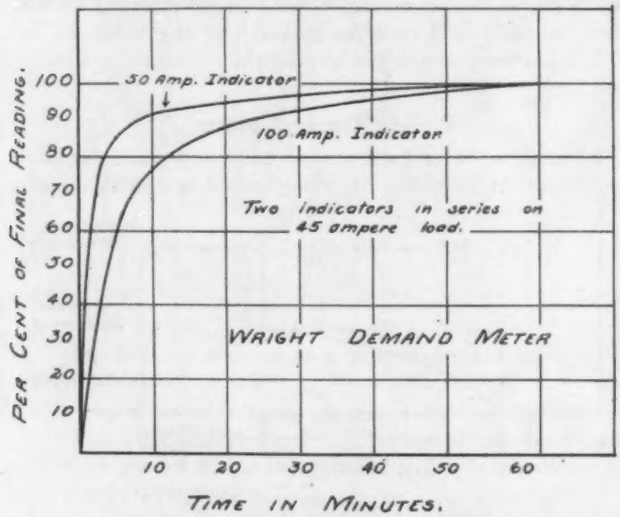


Fig. 6. Characteristic Curve of the Wright Demand Meter

voltage must be assumed if not known; its indication, among other causes of error, is affected by surrounding temperature; it can be used only on direct current or non-inductive a.c. circuits; two meters must be used on a three-wire circuit and their indications assumed to represent a simultaneous demand.

OZONE FOR THE CHILDREN—IV. OR ENGINEERING TWISTERS RETOLD.

"Gentlemen," he said, "I am not an engineer, but I belong to that branch of the public service known as the American Army. We often have many theoretical problems to compute in order to be prepared for the event of war. I have often thought of a contingency in messenger service in the army organization as follows:

"A messenger boy in the rear of an army 25 miles long is sent to the general who is traveling at the head. The army moves forward at the rate of 25 miles per day. The boy, after traveling a uniform speed all day, returns to his post in the rear by nightfall. What distance did the boy travel?"

Let v = speed of messenger in miles per day.

t_x = time it takes in days for messenger to deliver message.

$I - t_x$ = time it takes in days for messenger to return to rear post.

S_x = distance boy rides to overtake general.

Since the front of the army moves forward at the rate of 25 miles per day, it will travel in t_x days an amount equal to 25 t_x. Hence, since the boy travels from the rear to the front

$$S_x = 25 + 25t_x \quad \ldots\ldots (1)$$

Also since the boy travels at v miles per day in t_x days he will travel vt_x, or

$$S_x = vt_x \quad \ldots\ldots (2)$$

By combining (1) and (2), we have

$$25 + 25t_x = vt_x \quad \ldots\ldots (3)$$

$$\text{or} \quad v = \frac{25\,(1 + t_x)}{t_x} \quad \ldots\ldots (4)$$

On the return trip the distance traveled back from front to the point at which the rear has advanced is by similar reasoning $v\,(1 - t_x)$. Let the distance of this point from the place where the boy started in the morning be S_y.

$$\therefore S_y = S_x - v\,(1 - t_x) \quad \ldots\ldots (5)$$

$$\text{or} \quad S_y = 25 + 25t_x - v\,(1 - t_x) \quad \ldots\ldots (6)$$

But it is known that army advances 25 miles in the day's travel, hence this point S_y must be 25 miles from the morning's beginning. Hence by substituting in (6), we have

$$25 = 25 + 25t_x - v\,(1 - t_x)$$

$$0 = 25t_x - v\,(1 - t_x)$$

By substituting from (4), we have

$$0 = 25t_x - \frac{25\,(1 + t_x)}{t_x}(1 - t_x) = 25t_x - \frac{25}{t_x}(1 - t^2_x)$$

Clearing fractions and dividing by 25, we have

$$0 = t^2_x - 1 + t^2_x \text{ or } 1 = 2t^2_x$$

$$\therefore t_x = \frac{1}{\sqrt{2}} = .707 \text{ of a day}$$

Hence, the total distance traveled in 1 day ($t = 1$) $= v$ miles is from equation (4)

$$= 25\sqrt{2} + 25$$

$$= 60.25 \text{ miles.}$$

Q. E. D.

THE STANDARDIZATION OF INSULATORS

BY H. S. PERKINS

(Standardization of insulators is a question of vital importance to efficient central station practice throughout the West. The recent discussion at the Riverside convention forcefully brought out this fact. Here is a discussion by a representative of a prominent manufacturer of insulators that adds new light in that the view point of the manufacturer is set forth, thus rounding out this recent discussion so that all view points are now obtainable.—The Editor.)

Is is evident that there are on the market a considerable number of unwarranted pin type insulators for each voltage practiced; while on the other hand it is necessary to have a reasonable number of different designs for each voltage which are individually determined by operating and climatic conditions.

As manufacturers, it becomes difficult for us to determine from the many different designs on the market for any given voltage, just what designs we shall endeavor to standardize on or select as the most practical designs. Most of them undoubtedly have merit from an operating standpoint but it becomes an enigma for us to attempt to pick out the best of them and thereby avoid making all of them.

Manufacturers are interested primarily in producing excellent ware so that the many types mean nothing to them only from an economical standpoint of manufacturing, but general practice has been to leave with the manufacturer, not only the production of the material, but also the question of design and later its guarantee of operation in service. This is apparently on the wrong basis, for with the manufacturer should be left only the difficult position of producing an excellent and high grade ware.

To the operating engineer should unquestionably be left the selection of a proper design for a given installation, but because of the many designs catalogued, and otherwise, by different manufacturers, he is perhaps incapable of determining the proper design for a given installation and this is especially so where such installations present operating conditions different than those he has been intimate with.

Many of the larger class of central stations, we know, have systems which usually give them an incite of three-quarters of the usual operating conditions, normally encountered. Take the operating engineer though, who has a smaller system, operating, for instance, a 40,000 volt line at sea level. When he attempts to run a similar line over a mountain range where the characteristics differ, he is at the mercy of the manufacturer usually, for he depends upon him for the proper recommendation, unless he himself is well versed in the requirements. He can not be guided naturally by his experience in the valley for determining the proper insulator for the mountain range. As a consequence, regardless of whether the manufacturer recommends the type adopted or not, he is blamed for the failure of the insulators if such failure takes place.

Manufacturers, regardless of their engineering facilities, are not altogether capable of determining the proper insulator for most installations. He must be familiar with every organ in the system besides climatic conditions, to be of any real benefit to the operating engineer, under any conditions, in picking out a design.

In conclusion therefore, it is reasonable to believe that if the American Institute of Electrical Engineers and the National Electric Light Association will limit much of their discussion practiced in the past, and design insulators that will meet their particular operating requirements, the manufacturer will be left something definite to work on.

In college professors and research laboratories we have the theoretical talent and in the operating engineer we are presented with facts and practical experience; while the manufacturer is confronted with the possibilities of putting into practice the ideas of both the foregoing and shaping these ideas into a product worthy of the name of porcelain.

If the theoretical talent and the practical talent as represented by operating engineers can get together and actually design shapes suitable for predetermined working pressures under different climatic conditions, there is left with the manufacturer the question of economically producing such a shape with high manufacturing results in view.

The manufacturer can easily determine whether or not his product is properly shaped for economic manufacturing conditions by noting the percentage of loss from each kiln full at the time the finished product is tested. Where the loss is above a reasonable percentage, we will say, and giving the manufacturer a credit for making an excellent product, and understanding his business well, it is reasonable to assume that the design is responsible for the poor results, as shown by the percentage of loss. If this design therefore could be turned back for further consideration to the designers and consistent changes made, an insulator should be produced that can be somewhat standardized on.

With the establishing of standard types for each operating voltage and secondly types for given climatic conditions or otherwise, the operating engineer could easily determine his needs. By doing this the manufacturer can give his undivided attention to producing an excellent product and much of the expressions now in circulation that porcelain is not fit for insulators might possibly be done away with.

There are on the market many excellent insulators and yet many of these designs are still incorrect for any climate other than a dry one or where anything but normal conditions exists. Many of these are types which have lately been adopted by manufacturers as the last word in pin types but others see it different. The time is soon coming therefore when we will have on the market designs other than those already made and the engineering field will again be induced to experiment at a big item of expense, on new types to say nothing of changing the designs previously purchased in good faith and the expense of making new designs limits the amount of money the manufacturer might otherwise expend along ceramic line to better his product.

A manufacturer should spend his money in ceramic research and improvement more than he should for electrical improvements for it needs as much attention it appears as the designing demands.

Manufacturers need assistance from engineers and central station managers in their effort to bring about some plan whereby many of the above steps can be adopted one way or another.

ASSISTANCE IN DEVELOPING FOREIGN FIELDS

BY E. E. PRATT

("Where can I get positive and reliable information regarding engineering development with our foreign neighbors" is a question often asked by the engineer of the West, but few can answer. Here is an article by the chief of foreign and domestic commerce at Washington, D. C., relative to governmental assistance in developing engineering fields in Western South and Central America that should prove invaluable to engineers contemplating the establishment of foreign connections. Few realize the efficient service that is at the disposal of the American engineer simply by personal inquiry and correspondence with governmental authorities at the national capital.—The Editor.)

DR. E. E. PRATT
Chief of Foreign and Domestic Commerce, Washington, D. C.

WESTERN South and Central America offer one of the promising areas for the exercise in the next few decades of the energy, ingenuity, and capital of American engineers. What the individual man is interested in, however, whether he be an engineer looking for opportunities to use his training, a manufacturer of machinery and supplies, or a capitalist seeking openings for investment, is what is the particular field toward which to direct his attention and what facilities are available to enable him to acquaint himself fully with the possibilities there. We will outline these briefly in the present article, stressing particularly the work which the United States Government is doing to furnish this assistance.

It will be well for anyone who expects to become active on the west cost of Latin America to get as accurate an idea as possible of two things, first the geography of the coast countries, and second the spirit and character of the governments and people of these countries. With regard to the first the intelligent inquirer will find an abundance of printed matter covering the general aspect of the Pacific countries of South and Central America, but will find detailed studies hard to encompass. The reason for this is simply that commentators have heretofore been for the most part travelers who were attracted by the more superficial aspects of the regions through which they passed and seldom made concentrated investigations of any particular features. The man who is bent on getting all the data he can with regard to resources, minerals, railroad possibilities, contour of the land, etc., will find a number of sources of information open to him. A good bibliography of Latin American books is published by the Macmillian Company, New York, compiled by Mr. Peter H. Goldsmith director of the Pan American Division of the American Association for International Conciliation. It is usually available at book stores. Various magazines dealing with Latin America will also furnish information as to bibliographies, notably The South American, 61 Broadway, New York, which publishes lists of books on Latin America from time to time and the Bulletin of the Pan American Union, Washington, which has in each monthly issue notices of new books on Latin America. The Pan American Union also answers inquiries fully relating to every phase of Latin American affairs, and has a great amount of printed data of every description, as well as a large collection of photographs, in its library.

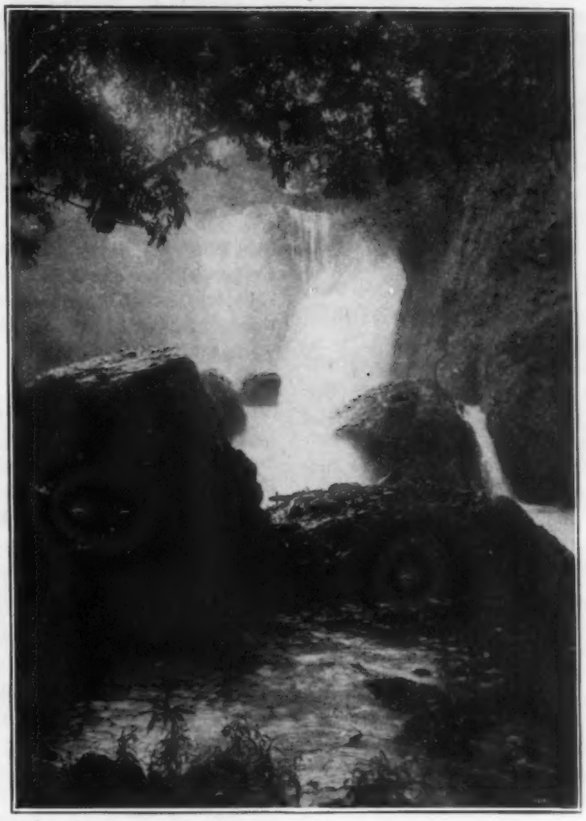
For giving oneself a Latin American education along these and other lines, few people realize how much the United States government has been and is doing in the way of furnishing information and getting our people in touch with Latin Americans. These efforts naturally center in trade promotion work, and this is carried on very largely by one Bureau in the Department of Commerce, the Bureau of Foreign and Domestic Commerce. This Bureau should be added to the list of sources of information given above and perhaps should be placed at the head of the list. It would certainly be unwise for any citizen of the United States to go to Latin America on any sort of business mission without first writing to the Bureau of Foreign and Domestic Commerce and learning what data that office had to offer him. For the last two years there has been a Latin American Division in the Bureau which is charged with the duty of giving special attention to inquiries of all kinds, particularly those relating to business ventures, connected with Latin America, and which has on hand a great deal of material available for answering such inquiries. This information is constantly flowing into the Department of Commerce in the shape of consular reports, reports of special agents, government publications from Latin American countries, and periodicals of various kinds dealing with Latin America, and the accumulation of several years, duly classified and indexed, affords a wide range of information available to the general public.

The government's work in promoting trade and investments, however, is not confined to the answering of inquiries. The Bureau of Foreign and Domestic Commerce has an organization that includes, besides the home office in Washington, a number of permanent offices in foreign countries (four in South America and two on the west coast), a string of branch offices in the United States (including one at Seattle and one in San Francisco, and co-operative offices with the chambers of commerce in Los Angeles and Portland), and a corps of traveling agents who make extended investigations and elaborate reports on the various countries they visit, and send samples and photographs of the lines on which they are working. As a recent example of the extent to which the government is working to acquaint our public with Latin America, there were in Lima, Peru, at one time last month one commercial attache stationed there permanently and four special agents, stopping in the city for several weeks on their tours of trade investigation. Besides

the office of commercial attache in Lima there are similar offices in Santiago, Chile; Buenos Aires, Argentina; and Rio de Janeiro, Brazil. Of special interest to readers of this magazine will be the investigations now beng made or already made in the markets for electrical goods, construction materials, ports and transportation, investments opportunities, banks and banking, credit, and prime movers. The agent on electrical goods, an expert formerly in the employ of the General Electric Company, is at this writing in Peru, and will go from there to Bolivia, Chili, Argentina, Uruguay, and Brazil. He will cover not only the present classes of electrical goods to be found on the various markets, with their nationality, prices, and general description, but also the installations of power plants, kind of current furnished, hydroelectric possibilities and developments, electric tramways, and in fact anything and everything electrical that will interest manufacturer, merchant or (within limits) electrical engineer. His reports will be printed as received and will probably cover one country at a time. They can be obtained for a merely nominal sum by writing to the Superintendent of Documents, Government Printing Office, Washington, or by calling at one of the district offices of the Bureau of Foreign and Domestic Commerce.

The best method of procedure for the engineer or the trader who is thinking of making connections with Latin American countries is first, to visit a branch office of the Bureau mentioned, if any is located in his city. There are seven of these, in New York, Chicago, Boston, San Francisco, Seattle, St. Louis, and New Orleans. There he can acquaint himself with the organization, and examine at his leisure the publications of the Bureau. If convenient for him to do so he should visit the offices of the Bureau in Washington, and confer personally with those engaged in Latin American work. He should write or visit the Pan American Union, in Washington, for advise or information such as could be furnished by a traveler thoroughly familiar with the various countries. The staff of the Union is made up of men who have traveled extensively through South and Central America, and who will be glad to answer questions relating to travel facilities, hotels, railway fares, etc., as well as more fundamental aspects of the life of the people. If the inquirer is an engineer and wishes to engage in work connected with his profession, he should get in touch with some of the larger companies operating in South and Central America, such as the J. G. White Construction Company, the Cerro de Pasco Mining Company, the Du Pont Powder Company, the Ulen Contracting Company, the American International Corporation, the Braden Copper Mines Company, the Bethlehem Iron Mines Company, the Chile Exploration Company, W. R. Grace & Company, the United Fruit Company and Moore & Fox, engineers and contractors. It is highly advisable to make connections before leaving this country, and a knowledge of spanish will greatly increase the applicant's usefulness to his employers. If the inquirer is seeking to build up a business with Latin America it will be well for him to arrange to go to the principal countries or to send there a responsible representative, and either arrange for competent representation through native agents or establish his own branch houses. If neither plan is practicable he should send his traveling men to these countries regularly, but before doing so should make very sure of two things—first, that both he and his salesman have as thorough a knowledge of the countries and people as they can get in the United States (and this includes a knowledge of the language), and second that the salesman is of a type that will not antagonize and repel Latin American business men. If he makes friends easily with people of refinement, and has the instincts and manners of a gentleman, he should get on well in Latin America. It is absolutely necessary, however, that he should leave behind him any idea he may have had that the Latin American merchant is easily imposed upon or is unacquainted with matters of quality and price, and he should also get rid of the idea that dissipation in any form is the open door to business in Latin America. A clean-cut, well dressed, good mannered, and sociable gentleman is perhaps more highly appreciated for his genuine good qualities in Latin American business circles than in any other in the world.

The government, through its commercial attaches, its consuls, its traveling agents, and its Bureaus in Washington stands ready to give every assistance it reasonably can to every United States firm or individual that contemplates business activity in Latin America or other foreign regions.



WATER FALLS IN CENTRAL AMERICA

(Vast water powers are available throughout the length of the long stretch of the Andes Mountains in Western South America. These powers await only the magic touch of capital and the call of industry to bring their potential possibilities into a concrete reality.)

VAST SHIP-BUILDING ON PACIFIC COAST

(In the issue of March 15, 1917, a list of the vast shipbuilding on the Pacific Coast was published. This list was taken from the U. S. Commerce Reports. Only six ships appeared as being built upon the Columbia River. Here is an additional list, which shows as a conservative figure that some thirty million dollars in shipbuilding is there under way, comprising sixty ships, eighteen of which are big steel vessels of ten thousand tons displacement.—The Editor.)

Portland

Columbia Engineering Works, Linnton Station

Two wooden auxiliary schooners, one of which is the "Juana Costa," 178 ft. O/A, 156 ft. keel by 36 ft. by 14 ft., twin 200 h.p. Diesel engines, four masts, 1000 tons d.w. cap., for M. T. Snyder, New Orleans, La. Launching and delivery 1917.

Two wooden auxiliary baldheaded schooners, 189 ft. O/A, 167 ft. keel by 36 ft. by 14 ft., four masts, 1100 tons d.w. cap., twin 320 h.p. Diesel engines, for M. T. Snyder, New Orleans, La. Delivery of one May, 1917.

One wooden auxiliary schooner, 247 ft. by 38 ft. by 24 ft., 6 in., twin 320 h.p. Diesel engines for M. C. Keith, New York.

Northwest Steel Co., and Willamette Iron & Steel Works

Four steel steamers, "War Baron," "War Lord," "Vestervard," and "Vestersjod," 425 ft. by 54 ft. by 29 ft. 9 in., 5700 gross tons, 8800 tons cap., 10½ knots geared turbines, coal or oil fuel, three Scotch marine boilers, 210 lbs. S.P., to cost $950,000 each, for Lauritz Kloster, Stavanger, Norway. "War Baron" launched. Delivery of two May, 1917. First two have been bought by Cunard Line.

One steel steamer "Peder Kleppe," 5700 gross tons, 8800 tons d.w., 10½ knots, three Scotch marine boilers, 210 lbs. S.P., for Peder Kleppe, Bergen, Norway.

One steel steamer, "Willy Gilbert," 5700 gross tons, 8800 tons d.w., 10½ knots, three Scotch marine boilers, 210 lbs. S.P., for Willy Gilbert, Bergen, Norway.

One steel steamer, "John Erland," 5700 gross tons, 8800 tons d.w., 10½ knots, three Scotch marine boilers, 210 lbs. S.P., for John Erland, Bergen, Norway. Launching December, 1917.

One steel steamer, 5700 gross tons, 8800 tons capacity, 10½ knots, three Scotch marine boilers, 210 lbs. S. P., for undisclosed Norwegian interests.

Columbia River Shipbuilding Corporation

Eight steel steamers, hulls to range from 250 ft. to 315 ft. overall average d.w. 8800 tons, same as Northwest Steel Co., to cost $1,125,000 each, for Swedish interests. Three of the above vessels to be constructed under the "Isherwood" plan.

Albina Engine & Machine Company

Two steel freight steamers, 261 ft. overall, 251 ft. keel by 43 ft. 6 in. by 20 ft., 2100 gross tons, 3300 tons d.w., for A. O. Anderson & Co., New York, N. Y.

Four steel freight steamers, 261 ft. overall, 251 ft. keel by 43 ft. 6 in. by 20 ft., 2100 gross tons, 3800 tons d.w., for A. O. Anderson & Co., New York, N. Y.

Peninsula Shipbuilding Company

Three auxiliary wooden lumber schooners, "Alpha," "Beta," and "Gamma," 255 ft. 4 in. overall, 238 ft. below propeller, by 43 ft. 4 in. by 21 ft. 6 in., 1600 gross tons, 2600 tons on 20 ft. draft, cap. 1,600,000 ft. lumber, 2 hatches 14 ft. by 32 ft. twin screw, two 300 h.p. oil engines, four masts, for builders' account. Deliveries March, April and June, 1917. Two sold to Bowman Bros., Bergen, Norway, for $500,000. "Alpha" launched December 16, 1916. "Beta" launched March, 1917.

Two auxiliary wooden lumber schooners, 297 ft. 6 in. by 47 ft. by 27 ft., five masted, 2400 gross tons, 4000 tons capacity, two 400 h.p. oil engines, for undisclosed interests.

Standifer-Clarkson Company, North Portland

Two wooden schooners, 220 ft. by 43 ft. by 21 ft., four masts, double-decked, 240 h.p., Skandia semi-Diesel oil engines for salmon transportation, for Libby, McNeil & Libby, "W. F. Burrows" launched April 11, 1917. Designed by C. J. Carlson. Completion, May, 1917.

Two wooden schooners, 220 ft. by 43 ft. by 21 ft., four masts, double-decked, 240 h.p. semi-Diesel engines, for undisclosed interests. Designed by C. J. Carlson.

Supple & Ballin

Two composite wooden, steel reinforced vessels, 4000 tons d.w. capacity, 285 ft. keel, 309 ft. overall, 44 ft. beam moulded, 26 ft. depth moulded. Double diagonal planking, steel top sides, full powered motor ships, twin screws, full Winton Diesel engines, 1000 h.p. Built for Williams & Wigmore, Dover, Del.

St. Helens

St. Helens Shipbuilding Company.

One 5-master, "City of St. Helens," 278 ft. by 48 ft. 3 in. by 23 ft. 3 in., single deck, for lumber cargoes, cap. 2,200,000 ft. lumber, 1830 gross tons, two 320 h.p. Bolinder engines, 8 knots without canvas. Keel laid in two pieces, 22 in. by 24 in. by 134 ft. each, 4 steam winches for handling lumber at rate of 400,000 ft. daily, for the Chas. R. McCormick Co., J. H. Price, Designer. Launched January 16, 1917.

One auxiliary powered schooner, "S. I. Allard," 276 ft. by 48 ft. by 24 ft. 5 in., 1870 gross tons, capacity 2,200,000 ft. lumber, for the Chas. R. McCormick Co. Launching, March, 1917.

One wooden schooner, "Frank B. Stout," 206 ft. by 43 ft. by 16 ft., 495 gross tons, two 320 h.p. Bolinder engines, passenger accommodations, 650,000 ft. lumber, Hough steel cargo rig., for the California & Oregon Lumber Company, Brooklings, California. To cost $135,000.

Architect of schooners for Chas. R. McCormick Co., is J. H. Price.

Astoria

McEachern Shipbuilding Company

Seven auxiliary schooners, 250 ft. by 43 ft. by 21 ft. 6 in., four-masted, 2000 tons d.w., three hatches, fitted with two double electric winches, 1,750,000 feet lumber, fuel oil capacity for 7000 miles, two 240 h.p. direct reversible Skandia oil engines, for A. O. Anderson & Co., New York City. Jas. A. Sloane, Seattle, naval architect. Launchings January to November, 1917, inclusive.

One wooden motor ship, "Maid of Douglas," 250 ft. by 43 ft. 6 in. by 21 ft., 240 h.p. semi-Diesel engines, capacity of 1,600,000 feet lumber below decks, for the citizens of the state of Oregon. Ordered by Arthur C. Callan, Portland, Oregon.

Two wooden auxiliary schooners, 266 ft. by 43 ft. by 22 ft., 2100 d.w. capacity, 2,000,000 ft. lumber, 320 h.p. Bolinder oil engines, for A. O. Anderson & Co., New York City.

Wilson Brothers

Two auxiliary wooden schooners, 225 ft. by 40 ft. by 16 ft., 1000 gross tons, cap, 1,200,000 feet lumber, 825 h.p. trip. exp. engines, sublet by the St. Helens Shipbuilding Co., launching of "Latourell" January 15, 1917. "Wahkeena" already in service.

North Bend

Kruse & Banks

One wooden schooner, "Florence Olson," 235 ft. overall, 215 ft. keel by 42 ft. by 16 ft. 5 in., engines 13½-23-40 by 30, Babcock & Wilcox boilers, 1,250,000 feet lumber, to cost $200,000; for lumber trade. For Oliver J. Olson Co., San Francisco, Cal.

One wooden steam schooner, "Nann Smith," 266 ft. by 50 ft. by 18 ft., capacity 2,000,000 feet lumber, Scotch boilers, turbine engines, oil burning, to cost $225,000, for the C. A. Smith Lumber Co. Delivery February, 1917.

One wooden steam schooner, "Horrace Baxter," 235 ft. overall by 215 ft. keel by 42 ft. by 15 ft. 6 in.; capacity 1,250,000 ft. lumber, to cost $200,000. For J. H. Baxter & Co., San Francisco, Cal.

MERCHANDISING ELECTRICAL ENERGY

(In the merchandising of electrical energy the subject of auxiliary reservoirs and their period of operation has considerable influence upon the economic use of water and especially does it affect the rate that may be granted for electric power supply. This matter is discussed in the following lines by the commercial engineer for the Southern Sierras Power Company in the Riverside district where the economic use of the auxiliary reservoir is playing a most important role in the placing of power sales for the central station and at the same time in the development of the communities served.—The Editor.)

RESERVOIRS AND THEIR OPERATION

By ROSS B. MATEER

Too high a value cannot be placed upon the reservoir used in connection with the small motor operated pumping plant by the now successful rancher and who has progressed from a state approximating bankruptcy to comparative affluence. The many advantages of the storage basin appeal to him and none perhaps more than the, first, saving in initial investment, second, the fixed and equitable operating expense and third, the large yield per acre cultivated, and a result of (a) adequate irrigation and (b) flexibility of head.

Plant Investment.—Is the aggregate of expense incident to the cost of the motor and the pump, the installation of the motor driven unit and the construction of the reservoir in comparison with the high capacity pump driven with the "barking" oil engine or the large electric motor. All direct connected, centrifugal equipments installed in either redwood or concrete curbed pits and suitable for efficient service on properties heretofore watered by the large vertical, belt driven units permit of a saving in actual cash equal to, in many cases, a sum sufficient to construct an oil sealed earthen storage basin of ample capacity to conserve the water pumped by twenty-four hours continuous operation of the plant, and where the expense of a small motor driven unit is balanced against the fuel engine equipment a greater saving in first cost is evident, as heretofore referred to.

While the large plant is in service from thirty to fifty per cent of the regular irrigating season and at a rate per kilowatt hour commensurate with the load factor accorded the utility the small motor driven unit is in operation throughout the regular season or the entire year at a fixed or flat rate charge per h.p. of maximum demand equivalent to from sixty-two (62) to thirty-eight (38) per cent of the average meter rate charged for intermittent service, according to the number of consecutive months of use. In fact an aggressive public utility recently presented to its consumers the option of two methods of charging for all service rendered under its unit h.p. of maximum demand charge, either, first the designation in advance of the season of a certain operating period or second a graduated flat unit charge per h.p. of maximum demand according to the length of the season, as follows:

First Option

No. 1—12 months' service at $50.00 per year per h.p. of maximum demand, being equivalent to $4.166 per h.p. per month.

No. 2—11 months' continuous service at $49.00 per year per h.p. of maximum demand, being equivalent to $4.454 h.p. per month.

No. 3—10 months' continuous service at $48.00 per year per h.p. of maximum demand, being equivalent to $4.80 per h.p. per month.

No. 4—9 months' continuous service at $47.00 per year h.p. of maximum demand, being equivalent to $5.222 per h.p. per month.

No. 5—8 months' continuous service at $45.100 per year per h.p. of maximum demand, being equivalent to $5.625 per h.p. per month.

No. 6—7 months' continuous service at $42.00 per year per h.p. of maximum demand, being equivalent to $6.00 per h.p. per month.

No. 7—6 months' continuous service at $38.00 per h.p. of maximum demand, being equivalent to $6.333 per h.p. per month.

No. 8—5 months' continuous service at $33.00 per year per h.p. of maximum demand, being equivalent to $6.60 per h.p. per month.

No. 4—9 months' continuous service at $47.00 per year per h.p. h.p. of maximum demand, being equivalent to $6.75 per h.p. per month.

Second Option

Payment to be made on the following monthly basis: For the first month of service at $7.50 per h.p. of maximum demand.

For the second month of continuous service at $6.75 per h.p. of maximum demand.

For the third month of continuous service at $6.50 per h.p. of maximum demand.

For the fourth month of continuous service at $6.25 per h.p. of maximum demand.

For the fifth month of continuous service at $6.00 per h.p. of maximum demand.

For the sixth month of continuous service at $5.00 per h.p. of maximum demand.

For the seventh month of continuous service at $4.00 per h.p. of maximum demand.

For the eighth month of continuous service at $3.00 per h.p. of maximum demand.

For the ninth month of continuous service at $2.00 per h.p. of maximum demand.

For the tenth month of continuous service at $1.00 per h.p. of maximum demand.

For the eleventh month of continuous service at $1.00 per h.p. of maximum demand.

For the twelfth month of continuous service at $1.00 per h.p. of maximum demand.

The second option is generally chosen and results in the intelligent rancher watering his land throughout the entire year with a corresponding increased yield per acre under cultivation.

Considering the water level to remain normal and the horsepower input determined, the expense per season becomes a fixed equitable sum, which like the interest on the mortgage can be anticipated and provided for in the year's budget. Under the fixed charge per horsepower of demand water many times the quantity sparingly pumped under a meter schedule is available for irrigation purposes without the uneasiness

sometimes experienced as to the size of the monthly statement.

Again, if you please, consider the fairness of the flat unit charge per horsepower of demand from an analysis of conditions before and after, the change in plant equipment and construction of the storage basin and as noted in a district where the lift is high and alfalfa requiring over five hundred tons of water for each ton of hay marketed is the staple crop. Here with 1013 h.p. installed for the stinted watering of 2055 acres of alfalfa or 2.03 acres per h.p., the average expenses per season were $23.80 per horsepower connected or $11.75 per acre cultivated.

Apparently hopelessly in debt yet grasping as it were, at a straw, the change in equipment was sanctioned with gratifying results to farmers and the utility. The averages of an equal number of consumers operating from five to twelve months being forty-three dollars and thirteen cents per horsepower per year with an equivalent rate per kilowatt hour of one and two hundred ninety-five thousandths cents and a possible rate had a high seasonal load factor been maintained of nine hundred eighty-two thousandths of a cent. The cost per acre per season was eleven and one-half dollars with a continuous flow throughout the period operated of six-tenths of an inch.

Profits.—That scientific ranching is productive of a good profit is illustrated by the returns on a certain eighty acre tract, seventy-seven of which are planted to alfalfa. Through the season of 1916, ten hundred thirty-seven tons of alfalfa were grown at an expense of $1784 for water in an eight month period or at a unit cost of $1.72 per ton of hay. Of the total tonnage 877 per marketed for $12,175, yielding to the owner a profit of $9000. Conclusive evidence that a ranch will produce abundantly when, first, the soil is adapted for the growth of the crop chosen; second, the land is properly leveled and checked and third, when a small quantity of water is pumped at a reasonable expense and with an efficient plant to a large storage basin from which water can be drawn in such quantities as the soil and the growth of the crops demand.

It appears therefore that the problem confronting the quasi public utility engaged in the marketing of "juice" for agricultural purposes is largely the education of the rancher, not alone in scientific farming but in the duty of water and the methods of lifting it from subterranean basins with a minimum plant investment and an operating expense commensurate with the returns on the tonnage grown. Is not the solution of the problem the use of the small motor driven plant and the storage basin in lieu of the large equipment of poor load factor and which calls for repeated reductions in metered service to temporarily hold a consumer on the system?

When ordering electrolyte for storage cells the type of battery should always be specified since electrolyte, which is suitable for stationary batteries, is not generally best for self-starter and ignition batteries. The best results are obtained by using electrolyte of the proper specific gravity.

LONG DISTANCE SUPPLY OF ELECTRICITY IN GERMANY

BY CHAS. S. WINANS

(In view of the generally accepted high standing of German efficiency in industrial development, here is an article on hydroelectric activity in Germany that should prove for purposes of comparative study of unusual interest to engineers throughout the West. These data were collected recently by the American Consul at Nuremburg, Germany, and are just being made available for public disposition through the U. S. Commerce reports.—The Editor.)

The Prussian Government is considering the project of constructing a long-distance power plant in the neighborhood of Hanover, in order to accomplish a double purpose—(1) to aid the Deister coal-mining industry by using the coal in the proposed plant; (2) to obtain the power necessary to realize the contemplated connection of the district supplied by the State Oberweser power plants with the district supplied by the state power plant at Dowerden, so as to create on a practical, economic basis a continuous region of electrical supply extending from Bremen to Hanau. This project is also intimately related to the construction, in consequence of the proposed canalization of the Main, of reservoirs for the generation of electrical power at Mainkur, Kesselstadt, and Gross-Krotzenburg. The available water power of the Main in this district, which is estimated at a yearly output of 25,000,000 to 30,000,000 kw.-hr, will be used partly for supplying the district of Hanau, Gelnhausen, Schluchten, Fulda, Gersfeld, and Hunfeld, and will be partly conducted at a high tension to other power plants.

Herr Besk, in concluding his summary of the present status of the governmental supply of electricity in Germany, observes:

These large-scale preparations for a uniform supply of electricity under the supervision and financial co-operation of the state offer a guaranty that in the near future electrical current will be placed at the disposal of industry and agriculture under the most favorable conditions. By the long-distance supply from state power plants, which will be constructed within reach of water power or coal beds, the status of the local electrical works and the overland central stations will not be endangered. Instead of undertaking expensive enlargements these will cover their extra need of current from the long-distance plants. The transformation and distribution to the consumers remain, as before, a matter for the local works. They appear to a certain extent as intermediate dealers in electricity.

Through the uniform electrical supply of whole countries a compensation in the demand for power will be assured, with the possibility of utilizing all plants more uniformly and economically than before, when many local works at times had excessive demands made upon them, while at other times they had to supply only a small quantity of current. Regardless of other savings in a comprehensive organization of electrical production and distribution, one may not, from the standpoint of political economy, disregard the circumstance that our natural sources of power and land resources will not be squandered by careless working, but will be exploited in a productive and suitable manner for the general welfare of the country.

SUGGESTIONS FOR CONTRACTOR AND DEALER

DEPARTMENT CONDUCTED BY GEORGE A SCHNEIDER

(Cost of repairs for polyphase motors is a subject upon which accurate information is desired from many quarters, compilation of cost data from a large number of repair jobs have been made and tabulated in the following lines. Other subjects, too, are treated, such as notes on portable devices, cables and connections followed by discussion of new nomenclature for desk fans. This department is conducted by a well-known power apparatus specialist actively engaged upon the problems discussed herein with a large electrical supply house in San Francisco and as a consequence their value to the contractor and dealer should be of unusual merit.—The Editor.)

COST OF REPAIRS FOR POLYPHASE MOTORS

At the request of a number of our readers we are reproducing a part of a table showing the approximate cost of repairs for polyphase motors used originally in connection with an article by the writer which appeared in the January 1, 1916, issue of the Electrical Review and Western Electrician. This table has been revised to take into account the increased cost of the materials entering into such repairs and therefore bring the estimates more in line with the present cost of this work. The subject matter of the original article is given in the following paragraphs in a condensed and slightly changed form.

The table is suitable for 60-cycle two or three-phase squirrel-cage motors wound for any of the standard voltages from 110 to 550 inclusive.

Cost of Repairs for 60-Cycle Polyphase Motors

Horsepower	Synchronous Speed in R.P.M.	Frame Size	Stator Winding	Resoldering Rotor	Bearing Linings, Per Set of Two	Painting	Recrating
.5	1200	C	26.25	2.50	1.35	1.00	1.00
.5	1800	A	24.25	2.25	1.35	1.00	1.00
.75	1200	E	28.00	3.00	1.85	1.00	1.00
.75	1800	B	24.25	2.25	1.35	1.00	1.00
1	900	G	34.75	4.00	3.10	1.50	1.50
1	1200	F	28.50	3.00	1.85	1.25	1.00
1	1800	C	26.25	2.50	1.35	1.00	1.00
1.5	1200	G	34.75	4.00	3.10	1.50	1.50
1.5	1800	E	28.00	3.00	1.85	1.00	1.00
2	1200	G	34.75	4.00	3.10	1.50	1.50
2	1800	F	28.50	3.00	1.85	1.25	1.00
3	900	I	53.50	6.50	5.25	1.50	1.50
3	1200	H	48.50	4.75	3.55	1.50	1.50
3	1800	G	34.75	4.00	3.10	1.50	1.50
5	900	K	73.75	8.75	8.05	1.75	2.00
5	1200	I	53.50	6.50	5.25	1.50	1.50
5	1800	H	48.50	4.75	3.55	1.50	1.50
7.5	900	L	70.75	12.00	7.85	2.00	2.50
7.5	1200	J	59.50	7.00	6.60	1.75	2.00
7.5	1800	I	53.50	6.50	5.25	1.50	1.50
10	900	M	75.00	13.25	7.85	2.00	2.50
10	1200	L	70.75	12.00	7.85	2.00	2.50
10	1800	J	59.50	7.00	6.60	1.75	2.00
15	720	P	93.75	15.50	10.25	3.00	4.00
15	900	N	71.25	14.25	10.25	3.00	4.00
15	1200	M	75.00	13.25	7.85	2.00	2.50
15	1800	K	73.75	8.75	8.05	1.75	2.00
20	600	S	156.25	19.00	12.10	3.25	6.00
20	900	P	93.75	15.50	10.25	3.00	4.00
20	1200	N	71.25	14.25	10.25	3.00	4.00
20	1800	M	75.00	13.25	7.85	2.00	2.50
25	600	S	156.25	19.00	12.10	3.25	6.00
25	720	S	156.25	19.00	12.10	3.25	6.00
25	900	R	143.75	17.75	12.00	3.25	6.00
25	1200	P	93.75	15.50	10.25	3.00	4.00
35	600	T	187.50	20.50	19.95	3.50	6.25
35	720	S	156.25	19.00	12.10	3.25	6.00
35	900	S	156.25	19.00	12.10	3.25	6.00
35	1200	R	143.75	17.75	12.00	3.25	6.00
50	600	V	218.75	21.75	30.85	3.50	6.25
50	720	V	218.75	21.75	30.85	3.50	6.25
50	900	T	187.50	20.50	19.95	3.50	6.25
50	1200	S	156.25	19.00	12.10	3.25	6.00

For most of the sizes listed the costs were arrived at by taking the average cost of repairs for a given frame and then applying this cost to the various ratings built in that frame. This will be apparent by comparing the costs for the different ratings. Take for example, frame G. The cost of rewinding the stator is $34.75. This figure has been applied to the following ratings all of which are built in that frame: 1 horsepower, 900 revolutions per minute; 1.5 horsepower, 1200 revolutions per minute, and 3 horsepower, 1800 revolutions per minute. The frame sizes specified do not apply to any particular line of motors, but were arbitrarily chosen for the purpose of this article. However, the relative output of a given frame at the different speeds will be found to agree quite closely with several lines of induction motors on the market.

These estimates may also be used equally well for motors of other frequencies by taking the figures applying to a 60-cycle rating built in the same frame. This comparison can be easily made by referring to the manufacturer's rating and dimension sheets for that particular line of motors. The tables may be further applied to slip-ring or phase-wound motors, since the cost of rewinding the rotor of such a machine will not differ materially from the cost of rewinding its stator. On this basis the cost of completely rewinding a 10 horsepower, 1800 revolutions per minute slip-ring motor built in frame J will be $119, or $59.50 for the rotor or stator separately.

The estimates for rewinding the stator or resoldering the rotor do not include any preliminary work required to put the stator structure in fit condition to receive the new winding or work required on the rotor before the actual resoldering can be started. In other words, the figures cover only the actual rewinding or resoldering, as the case may be. However, this preliminary work is frequently necessary and must always be considered in making up estimates. It is due to a number of causes.

For example, the motor bearing linings may have worn down sufficiently to allow the rotor to rub against the stator. If the motor has operated very long in this condition the laminations of either or both stator and rotor will probably be damaged, which may require considerable work to put them into their original condition. Again, a defective or broken bearing may injure the shaft. Sometimes this damage will be serious enough to require a new shaft. New bearing linings will probably be required in either case. Burned-out windings may also be accompanied by fusing of parts of the stator laminations. These fused portions must necessarily be removed before actual replacement of the coils can be commenced.

In a rotor which has been badly overheated, allowing the melted solder to be thrown out, arcing is frequently set up between the rotor bars and end rings, causing serious burning. When this occurs, new end rings are often needed, either for one or both ends of the rotor, or perhaps part of the bars will need to be replaced. With bolted end-ring construction there is also liability of trouble. The expansion of the end rings, caused by the excessive heat, tends to snap the bolts between the rotor bars and rings, producing the most favorable conditions for arcing. Burnouts of this kind, for either soldered or bolted construction, are quite common in connection with motors which have been started from time to time under loads requiring heavy starting torque with long periods of acceleration. Two or three-phase motors allowed to operate single-phase for any considerable length of time may also develop troubles of this nature. Very often the rotor will be badly damaged, while the stator has been only slightly overheated. Conversely, in some instances, the stator will be burned out, while the rotor is uninjured.

From these points it will be clear that estimates should not be made until after the motor has been given a careful inspection, otherwise there is likely to be a large discrepancy between the estimated and actual cost of the work. If an inquiry of this kind must be handled by letter it is not possible to make an inspection, but the dealer can at least detail clearly just what his estimate covers and point out the possibility of additional work that may be needed. Our readers will appreciate that estimates of this kind can be only approximately correct at the best. However, the table has been carefully compiled from data based upon a large number of actual repair jobs and it is believed these estimates will be found quite conservative.

NOTES ON PORTABLE DEVICES, CABLES AND CONNECTORS

Portable electric devices or appliances such as drills, hammers, grinders, lamps, motors and the like are probably handled with less care and precaution than any other class of electric apparatus. Especially is this true as regards the safety of the operator. Generally little attention is paid to the cords or connections until they give trouble. The cords are allowed to wear until they break or burn off. Then they are spliced and taped in a careless manner. Frequently the cords are allowed to lay on damp or wet floors or are hung on grounded pipes or machines. The connectors may have exposed live ends and are often of such design that the terminals are constantly under strain and therefore quite likely to be pulled out, loosened or broken off.

Many of these devices are operated from light or power circuits on which the voltage to ground does not exceed about 125 volts so there is not a great deal of danger from shocks. Still there is always the possibility of burns from arcs caused in handling connectors or from broken or burned cords. There is also an increasing tendency to operate portable tools from power circuits probably to take advantage of the more favorable rates. In fact the writer has noticed a marked increase in the demand for 220 volt tools during the past year. On most of these power circuits the voltage to ground exceeds 150 volts so it seems more caution should be observed in handling such portable devices as may be operated from these circuits. There are other chances of accidents due to defective cords or connectors which are generally not given thought. For example suppose a mechanic is working alone in the vicinity of a machine consisting of a number of moving parts located in a restricted space with a portable lamp as his only source of light. If the light becomes extinguished for any reason whatever there is always some chance of the workingman coming in contact with the moving parts of the machine. So from every point of view substantial, well insulated cords and portables are desirable especially when connected to power circuits.

The Bureau of Standards has realized the need of more care in handling these devices and have accordingly included rules to indicate the cautions which should be observed where the use of portables is necessary in the National Electrical Safety Code just recently issued.

These same rules in a slightly modified form are incorporated in the Electrical Utilization Safety Orders issued by the California Industrial Accident Commission. These orders became effective January 1, 1917. The general order covering these points is No. 729 entitled Pendants and Portables which reads as follows:

> **Pendant or portable conductors shall not be installed or used on circuits operating at over 150 volts to ground, unless they are of a type suitable for the voltage and conditions, and conform to the requirements of Orders Nos. 761, 762, 763, and 764.**

Electrical dealers, contractors, salesmen and others interested should take advantage of every opportunity to bring these orders to the attention of the proper persons in industrial plants, mines, garages and other similar industries in which portables of the various types are largely used. Dealers should also arrange to carry a reasonable stock of the better grades of portable lamp guards, plugs and cords. By following these two suggestions dealers should be able to considerably increase their business along these lines, at the same time doing their customers a good turn by selling them material which complies with the law instead of allowing them to select something which may at any moment be condemned.

NEW NOMENCLATURE FOR DESK FANS

The old term "desk and bracket" formerly applied to certain types of fan motors has been superseded by the term "non-oscillating." This will give two general groups of fans, oscillating and non-oscillating. These terms have been quite generally adopted by the various fan manufacturers in making up their 1917 catalogs and will without doubt greatly simplify the handling of fan business.

Dealers, salesmen and others interested are urged to adopt these terms at once and further to explain them at every opportunity to the layman. It is only by the combined efforts of the electrical fraternity in general that the best results of such standardization can be quickly obtained.

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING

(Concrete piping is coming more and more into use as the economic development of water supply in the West proceeds to higher development and more scientific utilization. The auxiliary reservoir continues to dovetail in the economic operation of electrical pumping plants. Both these matters are discussed in the following pages, the former by a well-known irrigation investigator at the University of California and the latter by the commercial engineer for the Southern Sierras Power Company at Riverside.—The Editor.)

A. Stands Before Placing B. Stands in Overflow System C. Pressure Causing Overflow of Control

Fig 1

CONCRETE STANDS FOR FURROW IRRIGATION

Some of the forms of concrete stands used in irrigation with concrete pipe distributing systems are shown in the accompanying illustrations. In Fig. 1-A stands made to saddle over the supply line are shown in the pipe yard. These have four openings in which the spout gates will later be placed. The pressure valves will also be set in the stand to control the flow from the supply line. In Fig. 1-B stands for the overflow system are shown, each group of 4 or 5 stands being set with their tops level and controlled by an overflow stand at the lower end of each set. Fig. 1-C shows the control stand of a pressure system. The controlling valve is set in the elevated stand. The height of the stand should be greater than the pressure head in the pipe line. In this case the pressure exceeds this height and overflow is resulting.

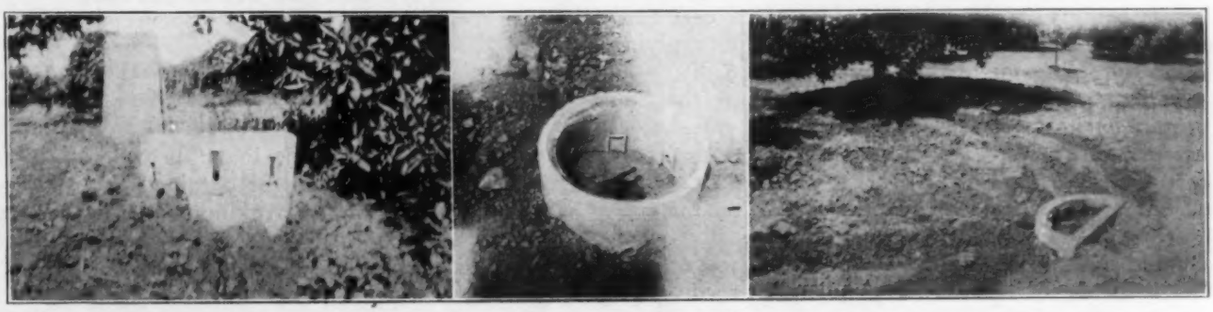
In Fig. 2 three types of stands used with the pressure system are shown. In Fig. 2-A, the stand is capped and the spouts placed on the outside. The pressure is outward on the slide spout gates so that heavier gates are required than for the usual open top stands. With capped stands there is also more difficulty from stoppage by leaves should such get into the water. Fig. 2-B shows a stand having an enlarged top of 16 in. pipe in which outlets for 6 furrows are placed. The control valve is placed at the top of the riser pipe from the supply line. Fig. 2-C shows a form of stand having a semi-circular top of 30 in. diameter for 4 furrows. This type of stand is frequently found in the vicinity of Whittier but is not used to any extent in new installations at present.

SMALL IRRIGATION PUMPING PLANTS WITH AUXILIARY RESERVOIRS

BY C. REMSCHEL

In the district near MacFarland and Wasco the principal crop irrigated is alfalfa. For this crop relatively large irrigation heads give much better results in flooding. The lifts vary from 40 to 60 ft. Electric power rates are based on a flat rate per horsepower per year. This combination of conditions has led to the use of small sizes of pumps with earth reservoirs. The pumps are set in pits near to the elevation of the water in the wells and direct connected to the motors. The average of the plants visited showed a capacity of about 4 g.p.m. of pump capacity per acre handled with these pumps and reservoirs. Where reservoirs are not used a capacity of 10 g.p.m. or even larger is usual.

With few exceptions only one well is used with each pump. These wells are from 100 to 150 ft. deep, 12 inch casings being generally used. The cost of such wells in this district, including casing, has been:



A. Pressure Stand Capped B. Six Distributing Gates C. Large Semi-Circular Pressure Stand

Fig. 2

Up to 100 ft	$2.50 per ft.
101 to 200 "	3.00 " "
201 to 300 "	3.50 " "
301 to 400 "	4.00 " "
401 to 500 "	4.50 " "

The pits are usually circular in shape and 6 or 7 ft. in diameter. Some use rectangular pits having about the same area. The lining consists of a heavy floor on which the pump is set, a concrete wall 3 or 4 in. thick and about 2 ft. high, and a thin plaster lining to the surface. This thin lining is constructed by lightly plastering the surface of the soil with mortar on top of which a coat of one part cement to four parts of sand about one inch thick is placed. Such pits are dry and clean and prevent dirt or water from getting into the pump or motor. No definite cost figures could be secured for such linings, the cost however is relatively low.

On account of the nature of the soil the water does not percolate through the ground very rapidly and the wells do not have a great pumping capacity. When pumping the vacuum is high which with a usual lift above the surface of from 4 to 8 ft. gives a total actual working lift of from 45 to 75 ft.

The use of reservoirs is general except for the large plants pumping from 100 to 200 miners' inches. Such large plants operate continuously. With reservoirs an irrigating head of 300 to 400 in. can be secured for the time used in actually irrigating and a much more efficient distribution of the water secured. Some owners claim that such streams give from 25 to 50 per cent better results than streams of 75 to 100 inches.

The reservoirs used are rectangular, generally square, varying from 90 by 90 to 200 by 200 ft. The usual depth of water held is 4 ft.; with some of the larger ones the depth is 5 ft. It is considered desirable that a reservoir have sufficient capacity to store at least 24 hours pumping.

The reservoirs in the vicinity of MacFarland and Wasco are comparatively easy to build as the soil holds water well. The excavation from the inside is used to make the banks. Where the soil contains sufficient sand so that seepage is excessive, the reservoirs are puddled with about 16 inches of manure trampled down by stock. To excavate a reservoir 200 by 200 ft. with banks 5 ft. high requires two 2-horse Fresno scrapers for about 10 days.

One reservoir in sandy soil which had been oiled was visited. When new before oiling the seepage was at the rate of about a foot in depth per day. After oiling it lost only 7 inches of water by seepage and evaporation in six weeks at the end of the irrigation season. This reservoir was 240 by 70 ft. and 4 ft. deep. The cost for excavation was $54, a four-horse scraper being used for 9 days. The oiling cost $135 for 155 barrels of oil and $101 for hauling, applying the oil and fixing the banks, a total cost of $290.

These plants are under the system of the San Joaquin Light & Power Company. The rates most generally used were $50 per horse power per year based on the tested load, this has now been changed to $42.30 per horse power per year based on the connected load. Owing to the high load factor when operated with reservoirs the equivalent rates per kilowatt hour are quite low. The following records are representative of the equivalent rate per kilowatt hour used when operating under the former $50 rate.

Size of Motor Horsepower	Number of Plants Examined	Average Equivalent Rate per kw.-hr. in cents
3	6	2.38
5	6	1.05
7½	6	1.24
10	6	1.08
15	6	1.01
20	3	.91
25	3	.84
30	3	1.06

The natural tendency of those constructing pumping plants is to install pumps of sufficient capacity so that operation for only a portion of the time will be required. This results in a low load factor for the use of power and a high rate per kilowatt hour if the rates for power used in irrigation are to return the cost of such service. The small plant operated continuously can be made to be of advantage to both the consumer and the power company. The first cost of construction of the smaller capacity plant with a reservoir will not be materially different from that of a plant without the reservoir but having a larger size of pump. With the smaller sized pump the draw down while pumping is usually less giving smaller total lifts. The smaller pumps have lower efficiencies than the larger one, this loss will frequently be balanced by the less lift. With reservoirs the company secures a more uniform load with a high load factor during the months when irrigation is practiced.

TEST OF DEEP WELL TURBINE PUMP

A 15 in. type CLC 5-stage, 110 ft. Layne & Bowler pump has been tested by the Arizona Experiment Station under the direction of G. E. P. Smith, the results being published in the twenty-sixth annual report. The pump was set in a well with the bottom of the bowls 28.5 ft. below the normal water level. Thirty feet of 6 in. suction pipe were attached below the pump bowls while above were 105 ft. of 7⅝ in. column pipe and the pump head, the discharge outlet being 86.3 ft. above normal water level.

The pump was belt-connected to a 30 horsepower motor. A watthour meter was used to measure the input to the motor and the motor efficiency determined for various loads with a Prony brake. The belt, including a quarter turn, was assumed to have a loss of 8 per cent. The draw down was determined with an electric tester and steel tape. A pressure gage was installed just below a gate valve on the discharge, the sum of the pressure gage reading and the static head being taken as the total head. The discharge was measured over an 18 in. weir. The discharge and head were varied by means of the gate valve in the discharge pipe. The results of the test are given in the accompanying table:

Test of 15-inch Deep Well Turbine Pump

Pump Speed r.p.m.	Total Head feet	Discharge g.p.m.	Efficiency per cent
903	91.1	301	64.2
1031	136.1	250	60.6
1030	127.7	338	75.4
1019	108.6	417	71.4
1242	97.1	717	55.2
1225	154.9	535	66.8

The comment is made that "the tests show that a very high efficiency can be obtained with this type of pump if the pump is working under its best conditions of head and discharge, but that at other heads or other discharges the efficiency may be low. This emphasizes the importance of knowing the operating conditions in advance and of buying a pump especially designed for those conditions."

PACIFIC COAST SECTION N. E. L. A. CONVENTION

(The Pacific Coast Section of N. E. L. A. was extremely fortunate in having for its leadership at the incipient meeting an unusual array of constructive talent to pilot the initial journey in organization into safe and peaceful waters. The President's address, given below, should assist our readers throughout the West in conveying some of these masterly measures of preparation that are necessary for the successful consummation of a gathering of such magnitude as that recently held at Riverside. Other interesting features of this remarkable gathering follow this report.—The Editor.)

THE PRESIDENT'S ADDRESS

BY R. H. BALLARD

Marking an epoch in the industrial and commercial development of the West and Southwest, Pacific Coast Section of the National Electric Light Association convenes for its first annual meeting today. Here we see the realization of our long treasured dream—the formation of an association in this section of the country which, while embracing the ideals and underlying principles of the National Electric Light Association, also provides means for the proper application of those principles to our special conditions. Not until the National Association's convention in San Francisco did the conception begin to take definite shape. On that occasion the concerted effort of western representatives resulted in greater recognition of western interests in the councils of the National Association and at the same time gave the needed impetus to make the Pacific Coast Section an accomplished fact. Organization was perfected at a meeting held in Los Angeles on January 6, 1917, and the enthusiastic welcome accorded the Pacific Coast Section in all fields of its activities is the best evidence of its present need and future usefulness.

R. H. BALLARD

(The first president of the Pacific Coast Section, N. E. L. A.)

Membership

The wonderful work performed by the membership committee in the three and one-half months of our existence will be apparent to you from its report. It sets a mark for rapid organization. In our organization, particular attention has been given to the manufacturing, jobbing and contracting interests to develop a unity of effort within our area of operation and the response in membership from these interests has been quite gratifying. Their representatives have also met with us in committee work and it will be proposed to you at this meeting that hereafter they be represented on the executive committee. Conditions in our section of the country demand a close relation between all branches of the industry and it develops upon us to lead the way.

Aims and Purpose of Pacific Coast Section

It is but natural that outside of our organization there has been considerable speculation as to our purpose and aims. In other words, what and why is the Pacific Coast Section? Is it to combat municipal ownership—to resist regulation—to create or foster illusionary ideas regarding the duties and responsibilities of its members in their capacities as public servants? Does it embody ideas in conflict with the accepted principles of constructive economic and industrial development? What is it and why?

Briefly, the object of the association, as stated in its construction, is to promote the interests of its members, establish cordial and beneficial relations with the public and kindred associations and advance scientific and practical knowledge in all matters relating to the industry. In promoting the interests of its members, the association is encouraging the development of the electrical business as it directly affects its members.

One of the functions of the section is to serve as a clearing house for the ideas and experiences of its members. Instances are constantly arising where the larger companies must go to the smaller companies for ideas, suggestions and assistance in certain matters and, perhaps in more frequent cases, the smaller companies seek counsel in their problems from the larger companies. The advantage of a centralized and accessible source of information, where the experiences and problems of all companies, both large and small, are constantly being collected and arranged for quick reference, is obvious and we have now such a source of information and bureau for the interchange of views between members in this organization.

This organization stands emphatically and unequivocally for closer relations and broader understanding between the utility companies and the public and will work unceasingly to that end. It will encourage educational, co-operative and harmonious action among its members and while the officers and committees cannot do more than suggest policies to member companies, they can emphasize the principles of the National Electric Light Association, which include the full performance of duty to the public in providing good service at reasonable rates, with liberal extensions into new territories. The Pacific Coast Section will lend its assistance and influence to promote amicable relations between the electrical industry and the public, and at all times frankly co-operate with the regulating bodies.

Committee Reports

During these two days of business, our time will be well occupied with an exceptionally fine program of business sessions, which I urge every one to attend. Our committees have done excellent work in the short time at their disposal and the members have labored assiduously at their tasks, compiling excellent papers for discussion. I hope each member will consider it his special privilege to speak his mind during the sessions.

Commercial Committee.—Recommendations contained in the report of the commercial committee are worthy of your serious consideration:

(a) That the association lend its support to other organizations in the promotion and advertising of the electric business;

(b) That the large member companies lend assistance to the small companies in the securing of trained men; and

(c) That a comprehensive record and tabulation of rate schedules of all member companies be compiled and maintained in the secretary's office, which later might be distributed to member companies in the form of a rate book.

Engineering Committee.—Recommendations of the engineering committee which appeal most strongly to me are:

(a) The maintenance of a committee to co-operate with the engineers of the state commissions in working out needed revisions in existing rules and regulations and state laws affecting electric operation and construction.

(b) A continuance of systematic investigation of suspension insulators;

(c) Active co-operation with the National Association and manufacturers in the standardization of distribution transformers.

Accounting Committee.—Due to the requirements of standard systems of accounting, as prescribed by the several regulating bodies in our territory, the work of this committee has been confined to reporting conditions as they exist. A continuing committee to co-operate with the National Association in an endeavor to bring about a single unified system of accounting which might be adopted by all states in the Union, would be advisable.

Public Policy Committee.—The personnel of this committee is of such high character as to insure the correct treatment of questions of public policy. The committee's report, when presented, will be found to contain some practical and helpful suggestions concerning the intercourse between member companies, their employes, customers and the general public.

Capital Requirements

Capital investments of Class A member companies of Pacific Coast section now exceed $500,000,000, as part of the $3,000,000,000 invested by all Class A member companies of the National Electric Light Association.

With the ever increasing demands for electric service, utility companies must exert every energy to secure the capital necessary to meet the constant growth and this phase of the business is only now beginning to be appreciated even by those who have been directly confronted with this grave question. The great disparity in the requirements of capital between utilities and commercial undertakings is so marked as to at first thought challenge comparison. Speaking generally, a mercantile establishment can turn its capital four to eight times a year while a utility company requires four to five years to turn its capital once. It is thus apparent that utilities must be allowed a sufficient margin between earnings and expenses to pay a fair return on the money necessary to do business and not only must the return be sufficient to attract capital but every possible precaution and safeguard must be provided to assure the investor of the safety of his investment. This important phase of our business resolves itself into two factors, first, a fair rate of return on investment, and second, protection of investments already made. Furthermore, a utility which, through wise, skillful and diligent management, has reached a point of such efficiency that it is enabled to improve its service to its consumers, to operate at a lower cost, and to more advantageously finance its requirements, should not be crowded into a position where it will be stripped of all the benefits of its performance, but rather should receive a recognition which would tend to put a premium upon careful, economical and efficient operation. The regulating bodies must eventually recognize that the utility which is most successful is the one which can best serve the public.

Municipal Ownership

With the modern doctrine of concentration of production and unified system of distribution serving large areas with diversified demands, the solution of the much mooted question of municipal ownership will be worked out solely along sane and logical lines. Certainly, the solution is not through continued strife, with destructive competition or other equally unfortunate consequences. Harmony and concert of thought and action between utilities and municipalities are both necessary and advantageous. Many municipalities are served by companies giving good service at reasonable rates and performing their whole duty to the public at a high standard of efficiency as parts of links of systems operating throughout large territories surrounding the municipalities. It is quite obvious and beyond contradiction that the service furnished by these companies, keeping in mind that such service is adequate and reasonable, is of greater economic benefit than could possibly be given by plants which the municipalities might build to serve only their own local needs in competition with private systems.

Water Power Development

In California alone, the maximum potential water power development is estimated at 8,500,000 horsepower, of which at the present time a total of only about 750,000 horsepower has been developed. Ninety-four per cent of the potential water power development is located at sites where federal permits are required. In the Western states, water power development has been extensive wherever existing laws and want of laws have not stepped in to block the way, but in the past few years extensive steam turbine plants have been built instead of water power. The industry is in dire need of federal laws authorizing water power permits, suitable and adequate as a basis for large investment, to encourage development.

Public utilities are natural monopolies in the regions served and are recognized and regulated as such. Experience has taught that the usual result of competitive service is duplicated capital, upon which the public must inevitably, directly or indirectly, pay a return. The cry of "monopoly," or "tendency toward monopoly" in the development of water powers, however, is unfounded. None exists and none is threatened. If the entire development in the United States were in the ownership of a single corporation it would not constitute a monopoly of the available water power. Organization into large groups creates diversified investment and the ability to procure capital at minimum rates for extensive development. An important element of the cost of public utility service is the cost of money; nd such cost, whatever it may be, must be considered by regulating commissions in fixing rates.

Cost vs. Rates

Cost of materials, supplies and commodities of all sorts have jumped amazingly in the past two or three years, but a review over a longer period reveals the fact that there has been a constantly increasing level of prices, aside from the abnormal advancement in the immediate past. In the last sixteen years, the average price of stable commodities has so increased that the purchasing power of a dollar has decreased almost fifty per cent. While these figures apply specifically to articles of food, they serve as a fair criterion of the condition existing in all commodities. The costs of raw materials of every description have shown a corresponding increase. Yet in the face of this, the rates for electric service have been steadily falling. The decrease in rates has been in even greater ratio than the increase in costs of other commodities and certainly development in the art of generating and distributing electricity has not alone brought about this condition. Indeed, the question may well be asked as to how it has been accomplished. The answer is that organization, efficiency and business development, creating greater use from present investment, are after all the most potential factors.

We are now confronted with an enormous increase in the cost of fuel oil which affects all our member companies and is particularly serious to our smaller companies. The larger hydroelectric systems will, of course, have some advantage in additional business which will gravitate to their lines by reason of this increase, the higher cost of fuel hurting the small private plant to a greater degree than the large generating station.

In conclusion, I wish to thank the officers and committees for the energetic and untiring efforts they have put forth during the strenuous weeks of getting the section started on a solid foundation. All credit is due them for their loyal co-operation and I fully realize that this is an entirely inadequate expression of appreciation.

The future of the section depends upon the individual and enthusiastic support of all its members. Our interests are mutual and while some details of operation may differ among companies, the underlying principles are the same. By holding to this basic fact, our future is assured and I have every reason to believe that the Pacific Coast Section will be among the foremost in electrical development and progress.

HIGH LIGHTS OF THE CONVENTION

The first annual convention of the Pacific Coast Section of the National Electric Light Association has passed into history as the most important event that has occurred in the electrical industry of the West. Numerically the registration of four hundred and eighty-six represents the largest gathering of Western electrical men ever convened. It was a convention of all the electrical interests of the Pacific Coast and not merely the central stations. Executives, engineers, commercial men, accountants, manufacturers, jobbers and contractor-dealers were all well represented.

The convention was opened by a commercial session and closed by an engineering session, both sections being so crowded for time in the conduct of their discussion that parallel sessions became necessary, though not originally contemplated.

The outstanding feature of the opening session was President Ballard's address, printed in full in these columns, and John A. Britton's reply to the address of Mayor Oscar Ford of Riverside. Mr. Britton's address will be published as a part of the complete stenographic record of the convention which will be printed in its entirety in these columns as soon as available. The report of the secretary and of the membership committee showed close to 1500 members enrolled in the Section. The treasurer's report assured the financial stability of the organization during the first year of its existence.

Commercial Sessions

Stanley V. Walton, chairman of the commercial committee, presided over the three commercial meetings in characteristically able manner. The discussions were spirited and will undoubtedly lead to many improvements in existing conditions. To summarize the discussion at this time would but anticipate and feebly bring out the points made by the speakers whose remarks will be printed in full in these columns subsequently.

The salient recommendations in the committee's report were adopted by the meeting as a whole in the form of three resolutions:

1. That a plan be adopted enabling the smaller operating companies to secure assistance in the matter of obtaining salesmen and other trained help through the secretary's office of the Pacific Coast Section.

2. That the member companies of the Pacific Coast Section lend active co-operation and support to the California Association of Electrical Contractors and Dealers and that a proposed plan be formulated by the commercial committee.

3. That member companies be asked to send to the secretary's office enough copies of effective rate schedules, rules and regulations to provide each member company with a complete set, and that new rate schedules, as issued from time to time, be sent to the secretary's office in sufficient quantities to enable him to keep each member's book up to date.

In addition to the Public Policy Committee's resolution tendering the service of the member companies to the United States Government in the present crisis the following resolution was presented and unanimously adopted:

Whereas, the Supreme Court of the United States has, in a recent decision, laid down certain rules governing the occupancy of public lands for water power purposes; and

Whereas, Congress will be called upon, during this session, to provide legislation carrying into effect the principles enunciated in said decision; and

Whereas, the States of the Union, represented in this convention are particularly interested in legislation which will advance, and not retard, further development of water power in said states; for the purposes of conserving natural resources.

Now, therefore, be it resolved that Congress, through the Representatives of the several states, be memorialized to work for such legislation as will permit the occupancy of public lands for water power development, under substantially the following conditions:

That permit be granted by the departments involved should not be of a revocable nature, but should be for a definite period of time—not less than fifty years—and shall not be forfeited, except by appropriate proceedings in a court of competent jurisdiction, whenever the permittee shall fail to comply with the provisions of any Act of Congress in relation to the matter; and that if the government elect to take over the property, at the end of the term of years leased, it shall pay to the permittee a just compensation therefor; that the charges or rentals for all lands used shall be determined by the average horsepower sold or used by the permittee for any purpose other than the operation of the plant.

Committee on Resolutions

The report of the resolutions committee, J. G. Scrugham, A. E. Wishon and W. P. Southard follows:

We wish to place on record as the first resolution, one coming from the convention as a whole and expressing the sentiments of each individual member, a resolution acknowledging our full appreciation of the work done, and the unselfish co-operation of the Journal of Electricity and of its staff. To the Journal and its organization this convention is indeed indebted:

Whereas, the Journal of Electricity has freely published in its columns all of the papers and reports presented at the Riverside Convention of the Pacific Coast Section of the National Electric Light Association, and has also published a Daily Service Issue during the convention,

Be It Resolved, that this association hereby expresses its hearty thanks to the Journal and places on record its appreciation alike of the generosity and efficiency with which this service has been rendered.

To the Southern Sierras Power Company and its entire organization, who have done so much to make this convention a success, we express the thanks of the body:

Therefore, Be It Resolved, that this body extends its thanks for the untiring effort and splendid entertainment of this company. And, further, we thank them for that which we have heard of and anticipate for tomorrow.

Without reflection on other convention locations, or fully admitting the climatic claims of our Southern California brethren, your committee wishes to present the following resolution:

Whereas, the management and staff of the Glenwood Mission Inn have accorded most pleasing hospitality to members of this convention, we hereby tender our thanks for the excellent service rendered, and express our appreciation of the efficient manner in which the large convention attendance has been handled.

Whereas, our sister section, the Northwestern Electric Light & Power Association has so graciously provided official representation in the person of Mr. O. B. Coldwell,

And Whereas, Mr. Coldwell has been a live inspiration in the conduct of all our discussions.

Be It Resolved, That the Association expresses its deep appreciation of the Northwestern Association's co-operation, and its debt of gratitude personally to our genial friend, Mr. Coldwell.

In view of the untiring efforts of the officers and the convention committee in making such a tremendous success of this, our first, convention:

Be It Resolved, That the hearty thanks of the Section be extended to the retiring officers and to the convention committee, by a rising vote of all present.

New Officers

The officers elected for the ensuing year are: President, H. F. Jackson, Sierra & San Francisco Power Company, San Francisco; Vice-Presidents, Samuel Kahn, Western States Gas & Electric Company, Stockton, and E. R. Davis, Pacific Light & Power Corporation, Los Angeles; Secretary, A. H. Halloran, Journal of Electricity, San Francisco, and Treasurer, A. N. Kemp, Pacific Light & Power Corporation, Los Angeles.

The executive committee consists of R. H. Ballard, Southern California Edison Company, Los Angeles; Henry Bostwick, Pacific Gas & Electric Company, San Francisco; W. W. Briggs, Great Western Power Company, San Francisco; Wm. Baurhyte, Los Angeles; George A. Campbell, Truckee River General Electric Company, Reno, Nevada; D. E. Harris, Pacific States Electric Company, San Francisco; H. C. Reid, Pacific Fire Extinguisher Company, San Francisco; W. P. Southard, Albuquerque Gas, Electric Light & Power Company, Albuquerque, New Mexico; K. E. Van Kuran, Westinghouse Electric & Manufacturing Company, Los Angeles; F. S. Viele, Prescott Gas & Electric Company, Prescott, Arizona; A. Emory Wishon, San Joaquin Light & Power Corporation, Fresno, Cal.; A. B. West, Southern Sierras Power Company, Riverside, Cal.

THE ENGINEERING SESSIONS

The sessions devoted to the papers prepared by the engineering committee proved unusually interesting and instructive. Detailed reports will appear in later issues of the Journal. In brief this discussion may be summarized as follows:

Friday Morning

Mr. Lisberger read a report on transformer standardization which dealt with proposed standards of type, size, voltage, ratios, and so forth. The report indicated that definite standards have been formulated for single phase transformers of the voltage ordinarily employed in distribution, and that further work was contemplated covering three-phase transformers and those of the higher voltage, substation type.

Mr. L. R. Brown indicated the reduction of cost of manufacture which would follow such standardization. He stated that a number of power companies throughout the country had been approached on this matter and all had given their approval of the new standards.

Mr. L'Hommedieu pointed that a further economy would inure to the manufacturer as a result of susch standardization and which would undoubtedly be reflected in the price to the consumer, by reason of the possible reduction in the local stocks and that another result would be quicker service in supplying transformers.

Mr. Downing opposed too refined standardization of power house and substation transformers, stating that the varying

requirements of this service necessitated special designs in each case.

Mr. Jackson urged that greater attention be given to the standardization of design and voltage of distribution systems and pointed out the present tendency on the part of certain engineers to diverge more widely in this respect.

In connection with a proposed general order of the Railroad Commission covering safety of pole line construction, Mr. Bridge indicated the probable scope of the rule, stating that the commission intended to consolidate the several orders and statutes dealing with this subject and to reconcile the various conflicting provisions therein. He stated further that the commission wished to collaborate informally with representatives of the various overhead line interests in formulating this order and appreciated the spirit of co-operation which had characterized the work to date.

In discussing this matter Mr. Geibel advocated uniform construction in crossings of wire lines over railroads.

Mr. Jackson stated his opinion that no better standard of construction should be required in crossing over railroads than in crossings over main highways. He contended that the hazard to the traveling public was as great in the case of lines constructed along highways as those crossing over them, and proposed a uniform standard of construction to be employed throughout the line and the avoidance of special construction at crossings.

In reply to the last mentioned remarks, Mr. Babcock stated that special precautions were necessary at crossings of wire lines over railroads for the protection of the railway signal system, the continued operation of which was essential to the safety and service of the railroads.

In connection with the engineering committee's report on deterioration of insulators, Professor Sorenson described a portable oscillator, designed by himself and used with considerable success on the high tension lines of Pacific Light & Power Corporation in detecting faulty insulators which the merger failed to eliminate.

In discussing Mr. Jollyman's paper on high head turbines, Mr. Koontz stated that the experience of his company indicated the fallacy of the general supposition, that turbines of this type were subject to extreme wear.

Mr. Poole reported a case of unsatisfactory operation of turbines at an installation in one of their plants on Bishop Creek. In this case the erosive effect of sand and dirt, due to cloudbursts, so reduced the efficiency of the wheel as to render its continued operation prohibitive.

Such water conditions are, of course, unusual.

Consideration was next given to Mr. Klauber's report on dimensional standardization of the hardware for clevis cap suspension insulators.

On motion duly put and carried the local section of the N.E.L.A. recommended the adoption of a five-eighths inch bolt instead of a one-half inch bolt as proposed by the manufacturers' committee.

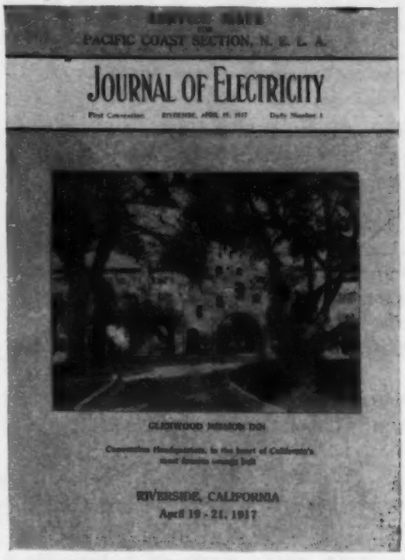
In discussing the subject of inductive interference and the work of the joint committee Mr. Warren indicated the inherent complexity of the subject, stating that the joint committee with limited time and resources had been able to do only the pioneer work of investigation. He hoped that means would be provided for the continuance of this work.

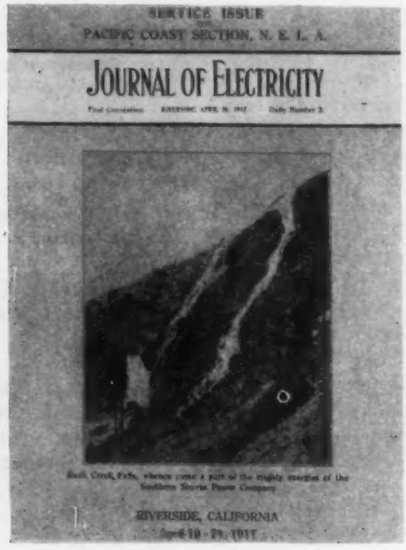
Mr. Bridge spoke of certain phases of the problem which the joint committee hoped to cover, based on information obtained since its first report to the Railroad Commission.

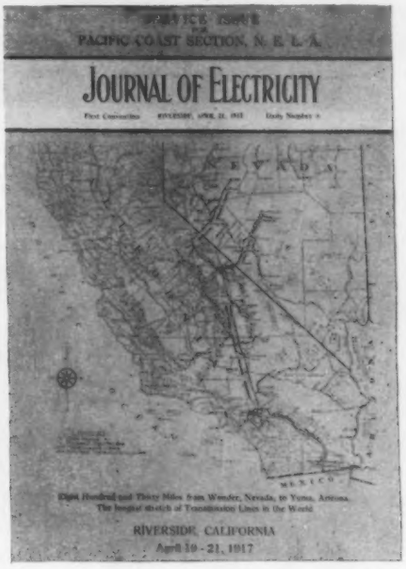
(Concluded on page 362)

THE SERVICE ISSUES OF THE JOURNAL OF ELECTRICITY

The Service Issues of the Journal of Electricity were published for the recent convention of the Pacific Coast Section of the National Electric Association by courtesy of the Technical Publishing Company, publishers of the Journal of Electricity. Their purpose was to report briefly the proceedings, official notices and incidents of the convention. Three issues were distributed gratis, one each on the mornings of Thursday, Friday and Saturday of convention week. The interest taken in their appearance was widespread throughout the convention attendance.







Their sizes were in the nature of "baby journals," seven by five inches, miniature in type, but in every other respect similar to the usual appearance of the Journal of Electricity. The issues proved so effective as to call forth a resolution of thanks from the convention hosts. The three pictures shown indicate the outward attractive appearance of these little "baby journals" which were so affectionately received on all sides.

Panoramic View of the Convention Members and Guests at the First Annual Convention

Shadow of Unseen Spirit
Rubidoux Hill

INSPIRATION must have literally been drawn from the very atmosphere, so successful proved the convention at Riverside. Perhaps the shadow of the Indian spirit, shown herewith which may be observed so mysteriously on any afternoon upon the crest of Rubidoux Hill that overlooks the city of Riverside, had something to do with it. At any rate the convention proved a great success from every viewpoint.

The banquet on Friday evening at the Glenwood was a unique and enjoyable affair. Good feeling and comradery existed to a high degree. The tables were a work of art in their setting with great transmission lines threading their way longitudinally and graced by banquetters on either side. Each guest was provided with a paper hat of "Uncle Sam" design and with the exquisite scenery of Spanish background on all sides the setting was truly enchanting.

In addition to a number of instructive and entertaining speeches the evening's program was enlivened into vociferous applause by the rendition of "The Song of the Lamp Socket" by a quartet from the Southern California Edison Company.

Saturday was devoted to sight-seeing. Sixty powerful automobiles conveyed the guests up to Pinecrest where luncheon was served a "mile high" above the sea which could, by the way, be dimly outlined upon the horizon to the West.

Too much credit can not be given to A. B. West of the Southern Sierras Power Company for his thoughtfulness and generosity as host of the convention and to R. H. Ballard of the Southern California Edison Company for his executive wisdom in predetermining all the little affairs incident to a convention and thus expedite the transaction of business and usefulness of a gathering of this nature.

THE SONG OF THE LAMP SOCKET

Music: "When I was a Lad," (Pinafore).

(By Charles Heston Peirson, with apologies to Pinafore).

(By the Percolator)

When I was a Kid I didn't aspire
To be such a sport as to boil by wire;
I stood on the stove 'til I got hot
And they called me the Darned old coffee pot
And I boiled and I boiled on stove and grate
'Til Hotpoint taught me to percolate.

Chorus:

He boiled and boiled on stove and grate—
'Til Hotpoint taught him to percolate.

(By the Toaster)

In days that are gone I used to toast
And I toasted so bad that I cannot boast
I toasted by wood and coal and gas
But I scorched and I burned and smoked, Alas!
I reeked with ashes and I caked with grit
'Til they taught me to toast from a lamp sock-et.

Chorus:

He reeked with ashes and caked with grit
'Til they taught him to toast from a lamp sock-et.

THE LADIES' PRIZES AND THEIR WINNERS

Prizes for the ladies proved attractive features of entertainment both aboard the Golden Gate Special and at the convention. Mrs. H. F. Jackson, Mrs. W. S. Berry and Mrs. E. B. Strong proved themselves to be gracious and efficient committee workers for entertainment of the lady guests.

On board the Golden Gate Special the prize winners were: Mrs. Dave Harris, Mrs. T. W. Simpson, Mrs. Geo. A. Campbell, Miss Gladys Strong and Mrs. Louis Levy.

At the ladies' card party at the Glenwood Inn prizes were won by the following:

Table No. 1—Mrs. W. S. Berry. Table No. 2—Miss Gladys Strong. Table No. 3—Mrs. A. C. Reynolds. Table No. 4—Mrs. R. H. Sterling. Table No. 5—Mrs. F. F. Maessen.

The following were the beautiful prizes and their donors:

Flashlight, presented by Electric Railway Manufacturers' Supply Co.; electric curling iron, presented

t Annual Convention of the Pacific Coast Section of N. E. L. A., Riverside, Cal., April 19-21, 1917

(By the Chafing Dish)

Of things that kill I have cooked my share
Such as hot Welsh Rarebit that brought despair;
I'm built for lobster and oyster stew
Or, the water for a toddy I will boil for you;
You push the button; I'll do your wish
For I'm the 'elec-tric Chafing Dish.

Chorus:

We push the button; he does our wish
For he's the 'elec-tric Chafing Dish.

(By the Iron)

Once on a time they called me sad
But now, By Jove, I am always glad;
I scorched and I burnt for the ladies fair
Those unseen garments that are called "white wear"
But I've quit my scorching as all may see
For the heat in my "tummy" is juice in me.

Chorus:

He quit his scorching as all may see
For the heat in his "tummy" is juice in "he."

by Pacific States Electric Company; electric iron, presented by Western Electric Company; electric iron, presented by Holabird-Reynolds Company; heating pad, presented by H. W. Johns-Manville Company; five Benjamin plugs, presented by Western Electric Manufacturing Company; hand electric lantern, presented by American Eveready Company; curling iron heater, presented by Electric Appliance Company.

Attractive boxes of candy were distributed to all the ladies.

The Victrola from Sherman & Clay and the records loaned by many members of the party aboard the special added much to the merriment of the party. The equipment and service of the Southern Pacific Company was excellent and much throughtfulness was displayed by Chas. S. Fee in wiring ahead to all division superintendents to show every courtesy to the guests of the special and provide every comfort and attention. While the return trip was lengthened by many unfortunate delays, the added period of time made possible additional pleasures and additional enjoyment that otherwise would have been impossible.

THE ELECTRICAL CONTRACTORS' STUNT

One of the most unique and catching stunts that were pulled off upon the Golden Gate special from San Francisco while on its journey to Riverside was the "baby doll" gift from the electrical contractors symbolic of the fact that the electrical contractors were the baby members of the Pacific Coast Section of N.E.L.A. Each member of the party—man, woman, and child—was presented with a baby doll, bedecked with neatly emblazoned ribbons, showing that the doll was from the baby members of the Section. Needless to say all members of the party prize the gift highly. Each gift is now in the enviable possession of the little tots at each of the respective homes.

Doll Baby Gift of the Electrical Contractors

It was a source of gratification to all to witness the splendid attendance and participation of the electrical contractors in the convention activities as was also the large representation of jobbers and manufacturers' representatives that was noted at this gathering.

The one outstanding feature of the convention was this evident spirit on all sides looking toward a closer understanding in the future between contractor, central station, jobber and manufacturer. And this splendid spirit of helpfulness and co-operation displayed at each section meeting and social gathering spells but one word for the future, and that word is "success."

Now that this convention has been so successfully consummated, much talk is going the rounds as to how members of the Pacific Coast Section of the N. E. L. A. may assist the Northwest Electric Light & Power Association in making the September convention at Spokane exceed even the wonderful success of former conventions of that association.

FUEL OIL AND STEAM ENGINEERING

(The mechanical horsepower, the kilowatt, the boiler horsepower and the myriawatt units, bearing irrational factors of relationship the one with the other, cause endless confusion in fuel oil and steam engineering practice. Here is a discussion that first traces the historical development of these important power units and then clinches the discussion by establishing quick and ready means of transferring the rating of boilers in one of these units to that of another. An instance of how the Builder's Rating is computed by taking the physical measurements of the boiler is also set forth in detail.—The Editor.)

HOW TO COMPUTE BOILER HORSEPOWER

BY ROBERT SIBLEY

How James Watt Would Have Standardized a Mechanical Horsepower at the Panama-Pacific Exposition

THAT energy is never created or destroyed is a fundamental postulate of modern engineering practice. All of our machines and driving mechanisms are, then, simply devices by means of which we may convert one form of energy into another form to suit our convenience or meet the demands of industrial activity. Thus an electric generator does not create energy but is merely a device whereby energy existing in the waterfall or in the steam turbine may be converted into electrical energy. Neither does the energy exist inherently in the waterfall, but due to the emission of heat from the sun, this water has first been drawn from the ocean into the clouds to be later deposited on the lofty mountain peaks. Due to this superior position it is enabled to develop water power energy and thus transfer the energy of the sun's rays into more useful form to ease man's burdens. And so with the steam boiler, we have fundamentally a mechanism by which energy latent in fuel oil or other combustible is first given out as heat energy of combustion to be immediately converted into latent heat energy of steam.

The Meaning of the Word "Rating."—The rapidity with which this conversion of one form of energy into another form may be accomplished is known as the rating of the mechanism involved. Thus a small boy may by means of a block and tackle hoist a huge weight to the top of a modern sky-scraper and at a later observation one may see a team of horses straining to their utmost to accomplish the same task. By close inspection, however, it will be found that the small boy has by means of intervening pulleys been able to take from thirty to forty times longer to accomplish what the horses did in a comparatively short time. Hence power, the basis of comparative effort, is the time rate of doing work.

The Development of the Word "Horsepower."—After his invention of the steam engine, James Watt soon found that he must devise some unit or measuring stick, as it were, with which to measure the power of his mechanism. As he was a pioneer in the art, he had to cast about for some convenient unit to adopt. What more natural unit should he consider than that of the draft horse? After watching a horse drawing up large cakes of ice into an ice house by the use of a snatch block, it occurred to him that when the horse pulled up a fairly good load he must be doing a certain amount of work. After making several experiments he found that by adding more sheaves to the blocks the horse could raise a greater load but it took more time to do it. He found that the average dray horse was able to raise a load of 550 lbs. at the rate of 60 ft. per minute, or to do 33,000 ft. lbs. of work per minute. This unit Watt called a horsepower and applied it to the measurement of the power of his steam engines.

The Boiler Horsepower.—In the early days of the steam engine the principle of the conservation of energy had not been firmly established. Indeed that heat was a form of energy at all was a debated question for many years after the steam engine became of vast practical importance.

Hence, since the energy latent in steam was not then known to be the underlying reason for the power driving action of the steam engine, the first rating of the boiler was made on the basis of power development in the engine which received its supply of steam from the boiler in question. Thus a boiler that could supply steam to operate a steam engine developing 50 indicated h.p. was said to be a 50 h.p. boiler. Later it became evident, due to the rapidly increasing efficiencies of the steam engine that such a rating was wholly variable. It was found, however, that under ordinary working conditions a boiler which could evaporate 30 lb. of steam per hr. at 70 lb. pressure and taking feed water at 100° F. could usually operate a 1 h.p. engine, consequently this mode of boiler rating became popular.

In 1884, the American Society of Mechanical Engineers adopted the following definition for the boiler h.p.: That a boiler evaporating 34.5 lb. of water at 212° F. into steam at 212° F. per hr. should be known as a 1 h.p. boiler.

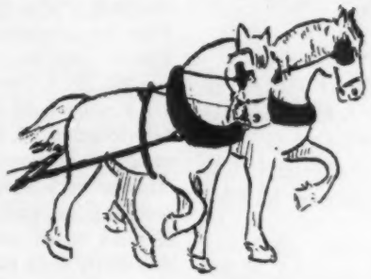
The Conversion of Boiler Horsepower to Mechanical Horsepower Units.—In later years the principle of the conservation of energy finally became well established and when engineers began to compute the actual energy represented in a mechanical horsepower

as originally adopted by James Watt and then compare this to the energy represented in the steam generated by what was known as a one horsepower boiler, it was found that the boiler horsepower represented the conversion in unit time of over thirteen times the energy represented in the mechanical horsepower unit acting over the same unit of time.

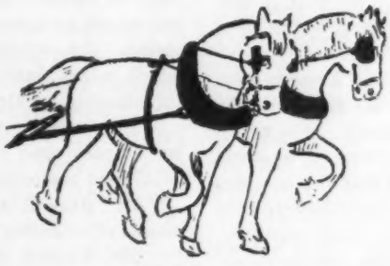
It is instructive to follow this computation as it will familiarize the reader with these two distinct units. Let us then proceed to an analysis. The mechanical horsepower unit is defined as a performance of work or conversion of energy at the rate of 33,000 ft. lb. per minute. Since 1 B.t.u. of energy has been found to have its equivalent in 777.5 ft. lbs. of mechanical work, it is seen that 33,000 ft. lb. of work per minute, or 1,980,000 ft. lb. of work per hr. may be represented by 2547 B.t.u. per hr. From the definition of the boiler horsepower above mentioned, as that adopted by the American Society of Mechanical Engineers, it is seen that since it requires 970.4 B.t.u. to evaporate 1 lb. of water at 212° F. into steam at 212° F., one boiler horsepower represents 34.5×970.4 B.t.u. per hr. or 33,479 B.t.u. of heat energy per hr. Hence, when we compare the boiler horsepower with the ordinary horsepower it is seen that the boiler horsepower represents a unit which is 13.14 times larger than the ordinary horsepower.

The Mechanical Horsepower
(The Unit of Power in Modern Steam Engineering)

The Kilowatt
(The Unit of Power in Electrical Engineering, which is 1.34 times the mechanical horsepower)



The Boiler Horsepower
(The Unit of Power in Boiler Practice, which is 13.14 times the mechanical horsepower)



The Myriawatt
(The Unit for Boiler Rating Proposed by Certain National Engineering Societies, which is 13.4 times the mechanical horsepower)

The Myriawatt as a Basis of Boiler Performance.—In recent years, due to the tremendous growth in the electrical industry, engineers have recognized the inconsistencies of the boiler horsepower unit and an effort has been made by the national engineer societies to make a more rational standard of rating. As a consequence, the American institute of Electrical Engineers has proposed that the Myriawatt be adopted as a standard of boiler rating instead of the Bl. h.p. A Myriawatt is the power equivalent of 10,000 watts or 10 kw. which converted into heat units become 34,150 B.t.u. per hr. Although it is still to be remembered that the Myriawatt does not yet make output and input of electrical units expressible in like quantities, since output is usually expressed in kilowatts, still the factor of 10 furnishes a basis readily convertible and makes possible a change in units without materially upsetting the old boiler h.p. range of capacity.

If, then, a boiler evaporates M pounds of steam per hour and the total heat of each pound of steam so evaporated be H and the heat of liquid represented in the feed water be h_f, then the rating of a boiler in Myriawatts is evidently

$$\text{Myriawatts} = \frac{M\,(H - h_f)}{34{,}150} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Relationship of Boiler Horsepower and Myriawatts.—Similarly, since one boiler horsepower is equivalent to heat absorption of 33,479 B.t.u. per hour, and a myriawatt to 34,150 B.t.u. per hour, then we may convert a rating in Myriawatts to a rating in boiler horsepower or vice versa by the relationship:

$$\frac{\text{Rating in boiler horsepower}}{\text{Rating in Myriawatts}} = \frac{34{,}150}{33{,}479} \quad (2)$$

The Builder's Rating.—In the commercial evolution of the steam boiler there has grown up a method of rating boilers by "rule of thumb" process. It is evident that the area of the steam generating surface of the boiler actually exposed to the heated gases of the furnace has something to do with the capacity of the boiler. For different designs of boilers, however, the particular factor to be applied varies widely. It has become of common acceptance, however, that 10 sq. ft. of boiler surface exposed to the furnace heat shall be considered on this rule of thumb comparison as equivalent to one boiler horsepower. Hence to compute the builder's rating of a boiler we must compute the area in square feet of the surface exposed to the furnace. By dividing this area A by ten we arrive at the Builder's Rating:

$$\therefore \text{Bl. h.p. (Builder's rating)} = \frac{A}{10} \quad \ldots\ldots\ldots (3)$$

As a detailed illustration, let us take the case of a Parker boiler installed at the Fruitvale Power Station of the Southern Pacific Company in Oakland, California.

This boiler is made up of three banks of tubes with two drums above, half exposed. In detail we compute as follows:

Tubes 4 in. diameter, circumference = 12.566 in. = 1.0472 ft.
Tubes 18 ft. long = 18×1.0472 = 18.85 sq. ft. of H. S.
Tubes 20 ft. long = 20×1.0472 = 20.94 sq. ft. of H. S.
Heating Surface, Bottom Row of Tubes:

20 tubes with 18 ft. of length exposed to gases = 18.85 × 20 = 377.00 sq. ft. Heating area

Heating Surface, First Pass:
100 tubes with 20 ft. of length exposed to gases = 20.94 × 100 = 2094.00 sq. ft.

Heating Surface, Second Pass:
80 tubes with 20 ft. of length exposed to gases = 20.94 × 80 = 1675.20 sq. ft.

Heating Surface, Third Pass:
80 tubes with 20 ft. of length exposed to gases = 20.94 × 80 = 1675.20 sq. ft.

Drums:
2 drums 54 in. diameter, 18½ ft. of length exposed to gases: circumference = 14.1 ft.;
½ of circumference 7 ft. = 7 × 18.5 × 2 = 259.00 sq. ft.
——— sq. ft.
Total ..... 6080.40 sq. ft.

Hence, we have that the builder's rating of this boiler should be

$$\text{Bl. h.p. (Builder's rating)} = \frac{6{,}080.4}{10} = 608.04.$$

To Compute Actual Boiler Rating.—Since it is seen from the fundamental definition of the boiler horsepower that the standard reference boiler generates its steam from water at 212° F. into steam at 212° F., we must next develop a factor by which we can reduce ordinary boiler performances of high temperatures and pressures to this fictitious standard before we can proceed further. The next chapter will be devoted to this consideration.

(Continued from page 357)

Afternoon Session.

In discussing Mr. MacDonald's paper, Mr. Warren emphasized the need of a rigid specification. He stated that the Bell companies are, in general, desirous of effecting joint use in urban distribution.

Mr. Northmore said that conditions in Los Angeles with three power companies, two railway companies and two telephone companies rendered joint use mandatory. As a result a joint pole committee was created and a form of contract drawn up which was still in use. He stated that the contract should be legally exact but the specification sufficiently flexible to meet changing conditions. Through co-operation between the various interests excellent results had been obtained, this attitude being essential to any success.

Mr. Cuningham stated that he does not favor a rental basis for joint use because of the difficulty and expense of computing the rents annually.

In closing the discussion Mr. MacDonald said that the original record system adopted by the Los Angeles Committee soon became cumbersome on account of the mass of data required to be furnished by the committee. This difficulty had been largely overcome by a changed system of recording the member companies now furnishing the necessary data.

The papers of Mr. Cuningham and others on line protective apparatus were next discussed.

Mr. Downing traced the development of switches and other protective equipment. He related the troubles of other protective equipment. He related the troubles of with non-interconnected air-brake switches, followed by oil switches which were troublesome owing to the lack of suitable non-inflammable insulating materials. The present day oil switch employing non-inflammable materials exclusively he described as being very satisfactory in its operation.

Mr. J. Thompson followed with a general condemnation of fuses. He said that fuses were usually unsatisfactory in their operation but are still a necessary evil on account of the need for economy in the construction of unimportant lines. He summarized the theory of fuse protection as the destruction of the weakest link in a power line and localization of the resulting damage. An essential requirement is that the material destroyed should be as cheap as possible.

Mr. Barre stated that in his opinion the use of fuses would be extended in the immediate future as a result of pressure which he expected would be brought to bear on power companies by the Federal Government in its campaign to augment the nation's food supply. The extension of facilities would require the exercise of most rigid economy in the construction of rural distribution lines.

Mr. Klauber stated that in his experience trouble ascribed to fuses was often due to improper fusing, and that the use of standard sets of fuses have largely eliminated this trouble.

In introducing the subject of Mr. Morgan's paper Mr. Woodbridge stated that one important problem of stand-by steam plant operation, is the possible reduction in steam supply to a steam turbine operated as a synchronous condenser without overheating the turbine blades.

Mr. Quinn said that his company had operated a 2000 kilowatt Curtis turbine as a condenser without steam and with no apparent injury to the blade. The method used was to open the man-holes and admit air to the turbine.

Mr. W. J. Davis described two methods of operation without steam—both of which he said would ultimately result in deterioration of the blade metal through overheating. One consisted of admitting air to the turbine and the other maintenance of a vacuum. He believed that in either case the resulting internal temperature would be too high, although in some cases periodic replacement of the blading might be less costly than the fixed charges on a separate condenser.

Mr. Lincoln and Mr. Koontz reported cases of satisfactory operation without steam employing a vacuum.

Mr. Downing stated that it was the practice of his company to operate turbines as synchronous condensers supplying steam to the extent of 5/10 per cent of full load requirements. He believed they could not afford to use a method which might damage turbines which are required constantly for standby service.

Mr. Wood stated that his method of carrying some load on the plant and rotating the boilers made possible extremely rapid load assimilation in emergencies.

Mr. Russell advocated insulation of boiler walls as a means of reducing standby fuel requirements.

Mr. Morgan said his tests indicated a definite rate of steam supply corresponding to the minimum temperature of the turbine when operated as a condenser. He reported an interesting case of neutralizing electrolytic corrosion of condenser tubes by means of circulating current supplied from a low voltage generator.

Professor Scrugham stated that it was the intention of the N.E.L.A. to give employment in electrical industries to two thousand college students during the summer vacations, and requested that all who might have use for such men would communicate with the secretary of the local section. He invited the submission of proposed subjects for research.

The world's gold production in the last quarter of a century equals that of the preceding four hundred years, and the silver output since 1878 equals that of the preceding four hundred years. The gold money of the world has doubled in the last twenty years and the silver money of the world has decreased one-half in the same period.

SPARKS—Current Facts, Figures and Fancy

(The recovery of waste products has been the financial salvation of many an infant industry. Below is a jotting of how the Japanese are making use of millions of cast-away oil cans to be later used for the manufacture of toys. In every central station the disposition of junk to advantage often becomes difficult. This item and others appearing in the "sparks" below may perchance give you an idea for bettering service or originating new channels of business endeavor.—The Editor.)

One-third of the world wool supply is today used in uniforms of men of the warring countries. In England alone in the first seventeen months of the war sixty-eight million pounds were used for this purpose.

* * *

The Jovian Order of Mansfield, Ohio, held a rejuvenation in which there were 13 members, who attended with 13 friends. The dinner cost $13, there were 13 tables, and it was held on Friday, the 13th of April.

* * *

Five million empty five-gallon oil cans were recently shipped as junk to Japan. These will some day appear again in American markets as tin soldiers and other toys dear to the heart of young America. This is a striking instance of recovery of waste products; why can't we Americans think of some of these things?

* * *

The entire resources of the Southern Pacific Company and auxiliary companies with their forty-five thousand employees are today aligned with the United States Government for the mobilization of troops and supplies, acting in concert with the Federal authorities under an arrangement worked out by a committee of railroad executives.

* * *

John D. Rockefeller, Jr., in a recent address at Cornell University states that although in the past chief executives of important industrial corporations have been selected largely because of their capacity as organizers or financiers, the executive of the future will be chosen largely on his ability to deal successfully and amicably with labor.

* * *

Letters are being written to the governors and fire marshals of the different states, and to the mayors, fire chiefs, health officers and chambers of commerce in several hundred of the leading American cities, urging that the first week in May (which this year began upon April 30th), be designated and observed generally as a spring "Clean-up Week."

* * *

The Electrical Review of London recites the fact that strong resentment on the part of British firms in Australia is being aroused by the extraordinary preference given to foreign manufacturers when material for construction is wanted. The procedure is said to exhibit such a bias in favor of American manufacturers that all others are practically excluded from consideration. While ever-increasing commercial and engineering relations with our Pacific neighbors is exceedingly desirable still no true American would want this trade for an instant unless devoid of bias and winning its entrance on service and quality alone.

The twenty national forests in California comprise almost twenty million acres of land and contain nearly nine thousand miles of road. There are in addition ninty-five hundred miles of trail which make accessible the more remote regions.

* * *

Just as fine fibre flax as is grown any place in the world can be cultivated in the Puget Sound region. This is the conclusion reached by Dr. A. W. Thornton of Ferndale, Wash., after an investigation of several years covering the soil, climate and water of the western part of the state.

* * *

Reports submitted by fifty-three railroad companies, comprising all that operate oil-burning locomotives in the United States, show that the quantity of oil fuel so consumed last year was over forty-two million barrels, a gain of 15 per cent over the consumption in 1915.

* * *

The production of copper from the mines of the United States for 1916 was more than double that of ten years ago and more than four times that of 20 years ago. The profit resulting from the domestic production was far greater in 1916 than in any previous year. It is probably safe to say that it exceeded $300,000,000.

* * *

According to the government census figures, electric light is practically the only item which has shown a decrease in the cost of living. This is mainly on account of the improvements in the incandescent lamps, but the cost of the current itself has also been reduced as a result of the rapidly increasing use of electricity for other purposes in the home and in industries.

* * *

Advise reasonable and sane use of the electrical pump for irrigation. If you want to grow the heaviest possible crops of alfalfa, and get the largest money return from the water used, do not apply more than thirty to thirty-six inches of irrigation water a year. To apply more than thirty-six inches usually does not produce corresponding increase in yield. Most California alfalfa-growers over-irrigate.

* * *

Four solid train loads of beans from the Orient, valued at over a million dollars and constituting the largest movement of this commodity ever coming to the United States, have arrived in San Francisco to be trans-shipped by the Western Import Company to Eastern markets. Here is an opportunity for increasing the central station activity at home in electric pump operation for the future in bean growing.

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THIS country of ours is admittedly the most blessed in finances, natural resources, productiveness of soil and in the ingenuity of her citizens. The only conceivable argument that can be advanced against a possible victorious outcome of the task ahead is that sufficient preparation and detail in organization were lacking. Let us take no chances. From the most skilled engineer to the helpless babe each has a part to play. The blind poet, Milton, has long since voiced those immortal words: "They also serve who only stand and wait." As engineers, we stand in readiness to play the part that best we may fill. We wait, but only that the assignment may be the more sure and the task the more thoroughly accomplished. We do not in the ordinary run of things send a dentist to babbitt a bearing or a mechanical engineer to put in a new crown. The only safe and proper way to conduct the gigantic task ahead is to draft the entire working force of the nation and put each at the task for which he is best fitted.

GRATEFUL THANKS

For months the editorial and managerial staff of the Journal of Electricity have worked to give of their best to make the convention at Riverside an unprecedented success. To have come back from that wonderful gathering of men of the electrical industry with the inward realization that the Journal had been a factor—no matter how small—in bringing about the successful consummation of that convention, would in itself have fully repaid them for all their efforts. To receive the following beautiful expression from the convention calls forth our deepest and most grateful appreciation and stimulates us one and all for still better and more effective work ahead:

"We wish to place on record as the first resolution, one coming from the convention as a whole and expressing the sentiments of each individual member, a resolution acknowledging our full appreciation of the work done, and the unselfish co-operation of the Journal of Electricity and its staff. To the Journal and its organization this convention is indeed indebted:

"Whereas, the Journal of Electricity has freely published in its columns all of the papers and reports presented at the Riverside Convention of the Pacific Coast Section of the National Electric Light Association, and has also published a Daily Service Issue during the convention.

"Be It Resolved, that this association hereby expresses its hearty thanks to the Journal and places on record its appreciation alike of the generosity and efficiency with which this service has been rendered."

Hydroelectric Preparedness

The beautiful and inspiring words expressed at the Riverside Convention by those who direct the great hydroelectric investments of a half billion dollars in four of the commonwealths of the West are a source of gratification to all who have followed the trend of evolution in utility development in recent years. The spirit of fair play and the spirit of patriotism so pervaded these official utterances that those hearing them in the audience involuntarily came to the realization that the hour of national need will not find the industries and arteries of human activity choked and throttled but, like the battleship Oregon rounding Cape Horn in the days of the Spanish controversy, American industrial activity enters upon the scene with boilers at full pressure and a store house of energy equal to any emergency.

A Spirit of Co-operation

The fact that stands forth as pre-eminent among all the interesting features that developed at the Riverside convention is the remarkable spirit of co-operation that was observable on all sides. While certain leaders towered above the general mass of assembled men of the industry still it was obvious on all sides that the real success of the convention was due in an unusually large degree to the contributions of the many rather than the few. Such co-operation as that engendered at Riverside can not fail to augur much not only for the future good of the Pacific Coast Section but indeed the electrical industry itself throughout the entire nation must ultimately feel its rejuvenating influence.

A Forceful Instance of Utility Service

The safety and welfare of the nation in times of war, as well as in peace, demand the continuance of the operation of transportation and of industrial and agricultural pursuits. Since the hydroelectric companies of the West are large factors in the furnishing of energy for transportation, and of energy for light, heat, and power purposes, particularly in the supply to industrials and for irrigation, the unanimous tender of system and service to the government of the United States at the Riverside convention came as an eloquent and graceful expression of the high sense of loyalty, patriotism and unselfish service engendered in utility evolution of modern times.

The Northwest E. L. & P. Association

Now that such splendid geniality and comradery has come down from the north in the personage of O. B. Coldwell and now that friendly and diplomatic relations have so auspiciously been thus established between the Pacific Coast Section of N. E. L. A. and the Northwest Electric Light & Power Association, it behooves the entire membership of the Pacific Coast Section to do everything in its power to make the convention of the Northwest Electric Light & Power Association at Spokane in September the crowning gathering of its many successful meetings of former years.

Such a thing as a special train to the north from California has not been an unknown event in the past. The glowing recollections of the Golden Poppy Special to Seattle some years back are too well placed in memory for that.

If there is one thing we must avoid in the present national crisis, it is to fight against paralysis of effort. The annual convention of the National Electric Light Association at Atlantic City has been called off. Undoubtedly the arguments for and against such action were carefully weighed before this decision was arrived at, consequently we pass this by without comment.

Nevertheless, the enthusiastic gathering at Riverside has thoroughly demonstrated the fact that men, even in these troublous times, can gather together and bravely plan for the future, bereft of fear or forebodings.

Hence to the Northwest Electric Light & Power Association Convention at Spokane in September all eyes now expectantly turn.

Stabilizing the Hydroelectric Industry

Much has been said in the past with reference to permits and rights of way across the national domain. The time for talk has long since past—action is what is desired.

The hydroelectric fraternity throughout the West has demonstrated during the present national crisis that it is deserving the highest respect and merits the full confidence of the nation. Its system and service have been freely and loyally offered to the government. All that is now asked is that a reasonable stability be given to the enormous investment of capital now held in hydroelectric securities in the West which amount to nearly three-quarters of a billion dollars.

The recent supreme court decision known as the Utah case denies to hydroelectric companies fee title to rights-of-way over government land and restricts their use so that they become as mere leases or easements issued by the Department of the Interior or Agriculture.

To properly and equitably adjust this entire matter new legislation should be enacted at the earliest reasonable period possible so that such permits as may be granted should not be of a revocable nature, but should be for a definite period of time—not less than fifty years—and should not be forfeited, except by appropriate proceedings in a Court of Competent Jurisdiction, whenever the permittee shall fail to comply with the provisions of any Act of Congress in relation to the matter. Since practically all hydroelectric promotion is accomplished by the floating of long time bond issues, the period of not less than fifty years is absolutely necessary for stabilizing investments of this nature.

Then, too, there is the question of possible acquisition of the property by the government. If at the end of the fifty year period the government should elect to take over the property, it should pay to the permittee a just compensation which would take into account all of the properties affected by the lease.

In regard to the question of rentals, no one denies that a reasonable charge should be made based upon the average horsepower sold or used by the permittee for any other purpose than the operation of the plant.

PERSONALS

A. B. West, vice-president and general manager of the Southern Sierras Power Company, the recent host of the first annual convention of the Pacific Coast Section N.E.L.A., brought out the unanimous unofficial and official hearty commendation of the convention for his splendid entertainment and untiring efforts in which the beautiful and gracious talent of Mrs. West is linked in all words of praise heard from those attending this great gathering.

Paul M. Lincoln, electrical engineer of the Westinghouse Electric & Manufacturing Company is at San Francisco from Pittsburgh.

Frank E. Bonner, engineer in charge of maps and surveys for the Forestry Service, is a recent San Francisco visitor from Washington, D. C.

Geo. H. Battee has been made president and general manager of the Aylesworth Agencies Company, of which **H. G. Aylesworth** is vice-president.

H. E. Bittman has resigned as secretary of the Telephone & Electric Equipment Company to become secretary of the Aylesworth Agencies Company.

W. P. Southard, manager of the Albuquerque Gas, Electric Light & Power Company, was an active delegate to the Riverside convention from New Mexico.

Ira J. Francis is to be made manager of the San Francisco office of John A. Roebling's Sons Company. He will be succeeded as manager of the Los Angeles office by **James Colkitt.**

George B. Muldaur, field secretary of the National Electric Light Association, was the official representative at the Riverside convention for President Wagner of the national organization.

H. P. Andrae, secretary-treasurer, representing Julius Andrae & Sons Co. of Milwaukee, with Mrs. Andrae, is spending a month on the Pacific Coast on a pleasure trip, having spent the past week in Los Angeles.

C. W. Forbrich, western manager of the Electrical Review and Western Electrician since 1908, has resigned his position to enter the advertising field on his own account, a plan which he has had under consideration for some time.

H. L. Aller, manager of the Pacific Gas & Electric Company of Phoenix, Arizona; **C. S. Thompson,** manager of the Bisbee Improvement Company; and **G. T. Herrington,** manager of the Flagstaff Electric Light Company, were delegates to the Riverside convention from Arizona.

J. G. Scrugham of the Elko-Lamoille Power Company; **F. H. Mechling,** manager of the Nevada-California Power Company; **George A. Campbell,** manager of the Truckee River General Electric Company, and **H. A. Lemmon** of the same company, were delegates to the Riverside convention from the State of Nevada.

E. H. Rollins of the financial firm of Rollins & Co. of New York City; **Guy Tablot,** president of the Pacific Power & Light Company of Portland, and **Max Thelen,** president of the California Railroad Commission and president of the National Association of Railroad Commissions, were among the distinguished guests at the Riverside convention.

M. Yokoyama and **T. Komuro,** electrical and chemical engineers, respectively, of the Yokohama Electric Wire Works, Yokohama, Japan, have left for eastern points after spending two weeks in San Francisco and Los Angeles. They are studying central station and transmission methods in this country. While here they were the guests of **H. F. Hartzell,** Los Angeles manager of Baker-Joslyn Company.

C. O. Poole, electrical engineer for the Southern Sierras Power Company ably entertained the guests of the Riverside convention by means of a stereopticon lecture on Thursday evening of convention week, in which he depicted the interesting engineering features of his system. Mrs. Poole proved herself an able help mate by her assistance in entertainment of the lady guests throughout the convention.

T. E. Collins, formerly sales manager of the Pacific Electric Manufacturing Company, is now engaged in the business of manufacturers' agent, representing the J. H. Parker Porcelain Company of Parkersburg, West Virginia, the Adams Bagnall Electric Company of Cleveland, Ohio, and will also act as general sales agent for the Bowie Switch Company. Mr. Collins is a Jovian Congressman from this district and an active worker in all affairs electrical.

O. B. Coldwell, general superintendent of the Portland Railway, Light & Power Company, has returned to Portland from a brief visit to California during which visit he was the official representative of the Northwest Electric Light & Power Association at the Riverside convention of the Pacific Coast Section of N.E.L.A. Mr. and Mrs. Coldwell won many friends in the southland and a host of new-made friends bemoan their early departure to the north.

W. L. McKinley of the Southern Sierras Power Company; **Joe Thompson** of the Pacific Electric Manufacturing Company; **R. E. Fisher** of the Pacific Gas & Electric Company; **L. S. Ready** of the California Railroad Commission; **W. R. Dunbar** of the Westinghouse Electric & Manufacturing Company, and **E. M. Cutting** of the Edison Storage Battery Company, are receiving congratulations on all sides for the splendid entertainment features they planned and executed on the Golden Gate Special.

Robert Eltringham, engineer for the California Industrial Accident Commission, was given an excellent opportunity to render first aid treatment to an accident victim on the return trip to the north of the Golden Gate Special, which crashed into an automobile and seriously injured its driver. In the absence of a doctor aboard, this striking instance of effectiveness of first aid treatment should impress all members of the electrical fraternity with the efficacy of knowledge of this kind.

Harry Noack of the Pacific States Electric Company, as registrar of convention delegates; **E. R. Northmore** of the Los Angeles Gas & Electric Corporation, as assignor of hotel accommodations; **Dave Harris** of the Pacific States Electric Company, as collector of prizes; **J. D. Redpath,** secretary of the Electrical Contractors' Association, as master of baggage, have won the unanimous approbation of the hundred and twenty-five enthusiastic guests aboard the Golden Gate Special for the success of this undertaking to the Southland.

The Journal of Electricity wishes to express grateful acknowledgment for valuable assistance rendered in publishing the Daily Service Issues at the Riverside Convention by **Ross B. Mateer** of the Southern Sierras Power Company as managing editor; by **Arthur F. Bridge** of the California Railroad Commission as technical editor in reporting discussions of the convention; by **R. M. Alvord** of the General Electric Company in compiling attendance data, and by **John A. Britton,** vice-president and general manager of the Pacific Gas & Electric Co., in publication of matters of public policy.

ROBERT SIBLEY, Editor.

MEETING NOTICES FOR ELECTRICAL MEN

(The National crisis has caused the calling off locally of many engineering gatherings. Its effect, too, is felt in the abandonment of the annual convention of the National Electric Light Association at Atlantic City. On the Pacific Coast, however, the opposite effect has proved true. Men of the electrical industry in an effort to keep activity as normal as possible have just completed the most enthusiastic and largely attended convention in the history of electrical gatherings on the Pacific Coast. Notations of meetings of interest to electrical men throughout the West may be found in the following lines with the exception of the convention of the Pacific Coast Section of N.E.L.A. which appears elsewhere in this issue.—The Editor.)

San Francisco Section A.I.E.E.

The regular monthly meeting of the San Francisco Section A.I.E.E. for the month of April was declared off due to the present international crisis.

San Francisco Electrical Development and Jovian League

The regular weekly meeting of the San Francisco Electrical Development and Jovian League for Wednesday, April 18, 1917, at the Palace hotel was devoted to a discussion of Coast Defense by Captain Malone, who gave a most interesting talk on the method of finding the range for modern coast defense work, in addition to much other explanatory matter connected with the organization of the national defense work.

W. L. McKinley of the Sierra & San Francisco Power Company, and Miles Steel of the Benjamin Electric Manufacturing Company, were both fined fifty cents under the new late fund rule. The money is to be turned over to the Red Cross.

Wednesday, April 25, served as an echo meeting of the recent convention of the Pacific Coast Section of N.E.L.A. H. F. Jackson of the Sierra & San Francisco Power Company, led in the discussion. He stated that the keynote of the convention was the spirit of harmony and unity that pervaded its meetings and the fact that it was the work of many pulling together instead of a few as is so often the case in such gatherings. Mr. Jackson is the newly-elected president of the Pacific Coast Section and much is expectantly looked forward to during the coming year due to his well-known executive ability.

An interesting talk on bees by John C. Froghliger followed an eloquent appeal by A. B. C. Dohrman in behalf of the National Red Cross Society. E. M. Cutting very ably acted as chairman of the day.

Los Angeles Jovian Electric League

Charles Lapworth, war correspondent, author and editor of the Los Angeles Graphic, gave the most interesting talk of the year at the luncheon on April 18th. His subject was "A Zeppelin Night in a London Newspaper Office." Mr. Lapworth was in charge of the night shift of the London Daily Mail during the early part of the war, and his graphic description of the startling events that took place in Great Britain during that time was intensely interesting. Mr. Frank M. Coker, manager of the Coker Electric Supply Company, was chairman of the day.

One hundred and fifty members, their wives and friends attended the luncheon on April 11th, the occasion being the annual celebration of Ladies' Day. A very interesting program with special features was arranged by J. H. Cunningham of the General Electric Company, who acted as chairman of the day. Albert Shiels, superintendent of public schools, the principal speaker of the day, outlined his plans for increasing the efficiency and broadening the scope of the work in the public schools in an interesting talk. His subject was "What our Schools are Trying to Do." Mrs. Martha Nelson McCann, Red Cross official, was presented with a large bag of currency representing the proceeds of the league's recent American Red Cross campaign, when five hundred fifty-four members were secured. Music was furnished by the Hubbard Musical Four.

BUILDERS OF THE WEST—IV

HARRIS J. RYAN

It is doubtful if ever a section of country was blessed with a group of builders so broad in vision and yet so constructive in the ideals that they have put forth as are to be found in our beloved West. That the great majority of these men are either engineers or else closely allied to the engineering profession is indeed a source of gratification to all who have followed the great feats of engineering and commercial enterprise that are so characteristic of Western effort. Among the first and foremost of the Builders of the West should be mentioned Harris J. Ryan, professor of electrical engineering at Stanford University, an engineer of brilliant research attainments and respected and beloved by all with whom he comes in contact.

The Technical Service Department at Portland

The technical service department of the Oregon patriotic service league, was organized Saturday evening, April 10th in the library hall in Portland, Oregon. Each engineering society has elected a representative, who is to serve as vice-president of the Oregon Patriotic Service League. These representatives are as follows: R. G. Dieck, American Society of Civil Engineers; L. T. Merwin, American Institute of Electrical Engineers; Joseph Jacobberger, American Institute of Architects; F. A. Olmsted, American Chemical Society; J. C. Henckle, National Electric Light Association; H. L. Vorse, Oregon Society of Engineers; A. G. Labbe, Technology Association of Oregon.

Geo. C. Mason, state chairman and associate member naval consulting board, has been elected chairman of the executive committee.

The technical service department of the Oregon Patriotic Service League entered the Patriotic Day parade Thursday afternoon, April 19th, in Portland, Oregon, with 500 technical men in line.

Automobile Engineers Organize at Portland

Men of engineering ability in the branches of automobile tractor and marine work will have an opportunity to associate themselves with the Society of Automobile Engineers in the plans now being advanced by that organization to co-operate with the national government in the present crisis. Elmer J. Clark, vice-president of the Portland Motor Car Company, dealers in Packard and Nash cars, who has been a member of the Society of Automobile Engineers for many years, has been appointed by the administrative officials to represent the organization in the Pacific Northwest, embracing Oregon, Washington and Idaho. Mr. Clark will en-

deavor to enlist engineers of proved ability and standing in the service and will be glad to discuss details of the society's plan with all applicants. He proposes to conduct a membership campaign for the Northwest immediately so that Oregon and her sister states may be recorded as doing their share.

Convention of N.E.L.A. Called Off

In view of present national crisis the Atlantic City convention of the National Electric Light Association has been abandoned. There will be a two day meeting in New York, May 9th and 10th, of class A and D members to discuss momentous matters in connection with war conditions. Annual routine business will also be taken up at this meeting.

The Pacific Coast Gas Association

The Pacific Coast Gas Association held its first get-together dinner of the season in San Francisco on the evening of Thursday, April 5th.

It was a memorable gathering in the history of the association. There was an excellent attendance of members from all parts of the Pacific Coast territory, and the ballroom of the Palace Hotel in which the banquet was held was appropriately draped with the national colors. It was without question one of the most enthusiastic gatherings ever held by members of this association. President C. B. Babcock, lately returned from his trip East, was in the chair and there were gathered around him men whose prominence in the gas industry is not of yesterday. The chairmen of the various standing committees reported progress, and among those called upon for remarks were Messrs. E. C. Jones, Henry Bostwick, John D. Kuster, F. A. Leach Jr., F. S. Myrtle, and M. L. Neely, all of "Pacific Service"; Leon P. Lowe, F. A. Cressey Jr., Wm. J. Dorr, T. P. Brooks, R. L. Cardiff and H. R. Basford. All of the speeches were to the point and were well received.

A feature of the evening was the adoption of the following resolutions which were transmitted by telegraph to the President of the United States at Washington and the Governor of California at Sacramento:

"Resolved, That the Pacific Coast Gas Association, in meeting assembled, tenders to your excellency the united, loyal and patriotic support of its membership, to be of such assistance to you and our nation as necessities may demand. The organization is composed of technical men who are used to problems and their solution, and bring with them in this tender of patriotic services the best wishes for you and your administration, with the assurances of loyal esteem and support."

Needless to say the adoption called for "The Star Spangled Banner" which was given with a will. It is with great pleasure that we record the receipt of the following reply from President Wilson:

"The President thanks you cordially for the good will which prompted your kind message which has helped to reassure him and keep him in heart."

An expression of sympathy and affection was transmitted to Mr. Frank A. Cressey, Sr., a charter member of the association and father of our past-president, who is confined to his home at Modesto by serious illness.

The association is now on the eve of the quarter-century mark, and while there are several of the "Old Guard" still on hand, its future destiny must rest with the younger men of the industry. That being so, it is refreshing to note the number of new members that the association is enrolling. "Good Old Reliable Gas" is doing business with greater energy than ever; in fact, from all accounts the industry is entering upon a new era of progress and prosperity. Gas men realize that they are to play a most important part in the industrial development of our country.

The second get-together dinner of the association is scheduled for Los Angeles on the evening of Saturday, June 9th. It has already been announced that the association will hold its twenty-fifth annual convention at Santa Cruz.

Annual Meeting of the Society for Electrical Development

The annual meeting of the Society for Electrical Development, Inc., will be held May 8th, at its offices in the United Engineering Societies' Building, New York City.

The society has some comprehensive sales plans to present which are expected to follow up the good work of "America's Electrical Week" and "Wire Your Home Time."

Following the annual meeting the board of directors will meet to elect officers for the ensuing year. The directors are expected to decide upon whether there should be another Electrical Week this year, or next spring, and to appoint a committee to take active charge of such a campaign.

Organization of Manufacturers of Automatic Electric Accessories

An organization of manufacturers of automatic electric accessories was formed at Atlantic City, New Jersey, Monday, April 16, 1917. The new organization will be known as the Automatic Electric Association. Among its members are the largest and best known manufacturers in this line. The purposes of the organization are to improve and develop this branch of automatic electric accessories' business through standardization and by friendly interchange of experience to design and manufacture. The following officers were elected at this meeting: G. Brewer Griffin, president, Pittsburgh, Pa.; C. O. Mininger, vice-president, Toledo, O.; G. S. Cole, secretary, Cleveland, O.; C. L. Amos, treasurer, Syracuse, N. Y.

The next meeting of this association will be held at Hot Springs, Va., May 17th, 18th and 19th.

UTILITY NOTES

Notes of Utah Utility Commission

Governor Simon Bamberger of Utah has named Judge Joshua Greenwood of Nephi, and Warren Stoutnour of Salt Lake City, and H. H. Blood of Kaysville on the public utilities commission created by the law recently enacted.

Judge Greenwood is a native of Utah. He is a lawyer by profession and for several terms has filled the position of judge of the Fifth Judicial District, which position he held until the time of his appointment to the commission.

H. H. Blood is prominently identified with the industries of Utah. He is manager of the Kaysville Milling Company and holds several directorships in Davis County banks, mercantile establishments and real estate companies.

Warren Stoutnour, the third member, is an engineer by profession. He was born at Everett, Pa., and is thirty-five years of age. He graduated from Lafayette College at Easton, Pa., in 1903 with the degree of civil engineer. While in school, he worked with the United States Geological Survey during his vacations. After graduation he came West and worked for the O. S. L. Railroad Company for six years, during which period he had a wide experience in railroad construction work. He then went to the Pacific Coast, where he was engaged as superintendent for various general and public constractors. In 1912 he returned to Utah and entered the employ of the Salt Lake & Ogden Railroad Company, the Bamberger electric line, as superintendent of construction which position he held at the time of his appointment to the commission. During this period he designated the bridges for the Utah Railroad Company, who were building a railroad from the Carbon County coal fields to Salt Lake City.

Western States Gas & Eectric Company

Western States Gas & Electric Company, Eureka, Cal., division, is negotiating for the power requirements of a local paper mill, amounting to approximately 400 horsepower in motors. William P. Bonbright & Company, Inc., and H. M. Byllesby & Company, have underwritten and will offer to the public a new issue of $1,564,000 six per cent gold notes of the Western States Gas & Electric Company of California. The notes are due February 1, 1927. The proceeds will provide funds for the retirement of $621,000 notes and for extensions and additions to the properties, and payment for recently acquired water rights and storage reservoirs on the south fork of the American River.

The Public Utilities Commission of Idaho

In the matter of the application of J. E. Goodman of New Meadows, State of Idaho, for a certificate of convenience and necessity to furnish electricity to the towns of Donnelly, Arling, Cascade, and the incorporated villages of Roseberry, and Van Wyck, all of Boise County, Idaho, the commission granted the request.

Notes of California Water Commission

Ed Fletcher of San Diego has applied to the State Water Commission for permission to appropriate 8 cubic feet per second of the waters of Escondido Creek in San Diego County for irrigation. The proposed works consist of a diversion and storage dam 140 ft. high, 400 ft. long on top and 200 at the bottom of concrete construction, capable of storing 12,011 acre feet of water, and two miles of main canal. The number of acres it is proposed to water is given as 3600 and the estimated cost as $250,000.

In one of the most important applications received recently, the Southern California Edison Company of Los Angeles, has applied to the State Water Commission for permission to appropriate 600 cubic feet per second of the waters of the North Fork of the Kern River and of Salmon Creek in Tulare County for the generation of electric energy. The application sets forth that on September 6, 1901, the California Power Company appropriated waters of Kern River for power purposes by posting notices of appropriation and on January 27, 1902, appropriated waters of Salmon Creek by like method, as was the law at that time; that applicant has since become vested with all the rights acquired by the California Power Company. The application then specifies the work done since the making of the original appropriations, the amount expended being given as $881,704.05. The estimated cost of completing the project, exclusive of transmission lines is given as $4,118,295.45.

The name of the works is Kern River Plant No. 3, and the following is a partial description given in the application: Diversion dam 60 ft. high, 240 ft. long on top and 200 at bottom, the top of the dam being 13 ft. above the ordinary water surface. The construction is to be of concrete with headgates in steel guides. The conduit is 13.4 miles long. Under the heading of "canal system" the application states that for 1000 ft. there is an open canal with concrete sidewalls with appliances for drawing off sand from the water. At the lower end of the sand-box system, a tunnel system commences, running to the fore-bay, except in certain places where reinforced concrete flume will be used. All tunnels are to be lined with concrete on bottom and sides. At 11.9 miles below dam, the tunnel crosses a gulch with a steel syphon pipe 9 ft. in diameter. From the forebay to the power house the water will be conducted in two steel penstocks seven feet in diameter at upper end and five feet at lower end. It is proposed to develop the power by two hydraulic turbines, direct connected to alternating current electric generators with a total capacity of 30,000 kw. The total fall to be utilized is 800 ft., between the forebay and the tail-race and the amount of power to be developed is given as 54,545 theoretical horsepower. The power house is to be of concrete. The application states that the proposed plant is to supplement the present plant of the company to meet the increasing demand for light and power, and it asks until July 1, 1922, to complete the constuction.

The city of Los Angeles has filed three more applications with the State Water Commission asking permission to appropriate waters at three different points for the purpose of generating electric power for the general power project outlined by that city. There are several other applications before the commission for the same project, each one of which represents a unit of the proposed municipal enterprise of the southern city. Fifty-six cubic feet per second is asked on Rock Creek, tributary to Owens River in Inyo County. The only data given on this application is that there is proposed a canal six miles long. It is to be known as the Rock Creek project. Permission is also asked to appropriate 10 cubic feet per second of the waters of Sawmill Creek, also tributary to the Owens River, this to be known as the Sawmill and Division Creek project. Nineteen cubic feet per second is asked from the waters of Baker Creek, tributary to the Owens River to be known as the Baker Creek project. The submission of complete data will be required before the applications can be acted upon by the commission.

BOOK REVIEW

Operation of Gas Works. By Walter M. Russell. Size 6 by 9 in.; 209 pp.; 76 illustrations; cloth binding. Published by McGraw-Hill Book Company of New York City, and for sale at the Technical Book Shop, San Francisco. Price $2.00.

In this book the author, who is manager of the Emporia Gas Company has endeavored to present the facts and details of gas works management in concise and readable form. This book is intended to supply the needs of foreman, superintendent, engineer or cadet, connected with a small or medium-sized gas works, who desires to increase and widen his knowledge of the principles and practice of gas making. No extended description of machinery or apparatus is attempted but rather the aim has been to give as simply and clearly as possible instructions for operating the standard types of apparatus usually found in gas works together with some discussion of the principles involved. The treatment of the text is taken up under six main headings: Organization and management, chemical control, coal gas, water gas, general plant operation, and calorimetry and photometry.

To western gas engineers whose duties are largely devoted to manufacture of oil gas this treatment of practice in coal and water gas plants will prove extremely useful for reference and study in co-ordination of the industry.

NEW BULLETINS

The Benjamin Electric Manufacturing Company has just issued most attractive publicity matter setting forth data to assist in the "Wire Your Home Time" campaign which is now being pushed as a national campaign.

The March Bulletin of the Philadelphia Electric Company is especially attractive and interesting in that it discusses a problem of vital import to other communities throughout the West, namely the rehabilitating of dwellings twenty-five to thirty years old.

The Crocker-Wheeler Company has issued Bulletin 176 on "Form R Induction Motor"; Bulletin 175 on "Form I Direct-Current Machines"; Bulletin 174 on "Form L Direct-Current Machines"; and Bulletin 173 on "Slot-Bridge Construction for Induction Motors."

Bulletin 72, just issued by the California State Mining Bureau, is entitled "The Geologic Formation of California with Reconnaissance Geologic Map." The extent and availability of our petroleum resources, which are so important in modern naval operations, are thoroughly covered by the Bureau in its work of protecting the fields from damage by faulty operations.

"Combustion in the Fuel Bed of Hand-Fired Furnaces" is the title of Technical Paper 137, by Henry Kreisinger and others, which has just been issued by the Bureau of Mines of the Department of the Interior. The main object of the investigation was to determine the conditions governing the process of combustion in the fuel bed of a hand-fired furnace. The results of this investigation furnish data for correct design of coal-burning grates and furnaces and their efficient operation. They also cast light on the important problem of clinker trouble as related to fusibility of ash. They further indicate the possibility of a high rate of gasification of coal in gas producers.

LATEST IN EVERYTHING ELECTRICAL

(The proper disposition of solid particles conveyed out into the open in waste gases has been a difficult and obnoxious problem in the industries of the West. Here is a description of a process that is proving eminently satisfactory in many quarters. The process is especially interesting and instructive to readers of the Journal in that a peculiar property of electric magnetization is made use of to accomplish its effective results. Other notations on recent advances in affairs electrical follow this description.—The Editor.)

EQUIPMENT NECESSARY FOR THE COTTRELL PROCESS

Standard 100,000 volt, 15 k.v.a. Westinghouse Cottrell Transformer

BY means of the Cottrell process, which is an electrostatic method of precipitating the fine solid particles carried by a moving gas through a flue, the suspended matter in smoke may be removed, cement dust cleared from the gasses generated during the process of manufacture, and flue dust removed from the gasses emanating from blast furnaces, roasters, converters, and the like. The process, which is widely used commercially to recover the metalic contents in smelter smoke and the fine dust produced in cement mills, is controlled by Dr. Cottrell and made available for use by the Research Corporation, New York, and the Western Precipitation Company, Los Angeles, California.

The usual Cottrell treater consists of a series of tubes, either rectangular or round in shape. In the centers of these tubes fine wires or chains are suspended, the wires or chains forming one electrode and the inner surface of the tubes the other electrode. As the surface of the wire or chain is very much less than the surface of the tube, far greater ionization takes place from this small electrode than from the tube surface. The gas thus receives a static charge of the same polarity as the suspended electrode, and the solid particles in the gas are projected against the inner surface of the tubes, where they tend to stick and accumulate until the electric current is turned off. The dust may then be loosened by rapping the sides of the tubes, and is collected in hoppers at the bottom.

The high static charge necessary for the suspended electrodes, is obtained by a unidirectional high voltage current of sometimes as high as 100,000 volts direct current, which is produced by rectifying a high tension alternating current. The high tension alternating current is secured from the regular alternating current supply by means of step-up transformers especially designed for the process. The rectification of this high tension alternating current is usually accomplished by means of a mechanical commutating switch or rectifier as it is called, run in synchronism with the low tension alternating current supply circuit.

The rectifiers are connected in the high tension circuit between step-up transformers and treaters. Balancing inductance and resistance are usually inserted in the high tension circuit to partially neutralize the electrostatic capacity of the treater and to bring the power factor up into the neighborhood of 80 per cent, leading.

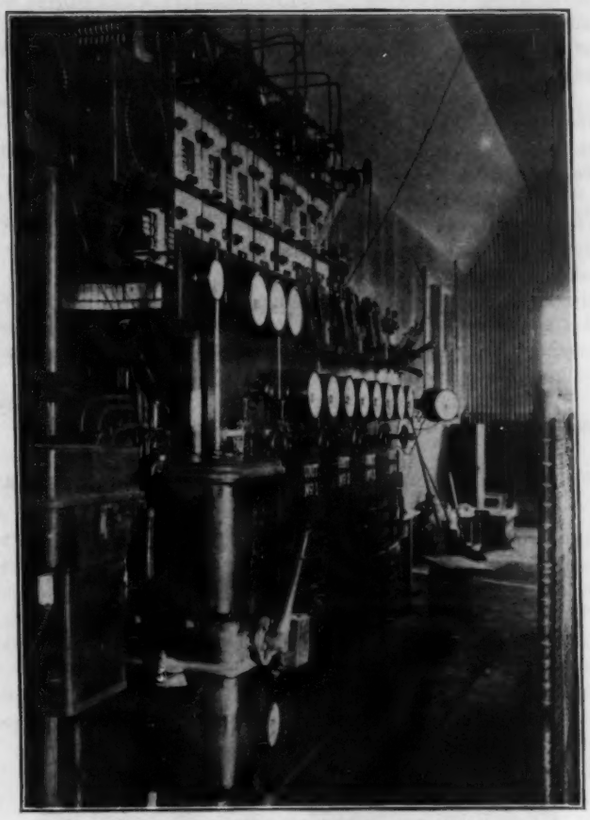
To meet the requirements of this process, the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has developed special apparatus for supplying the electric power required. The equipment furnished, which consists of a single-phase generator; small synchronous induction motor, a step-up transformer, and a switchboard with control devices, has been designed particularly for the work in question, along lines and suggestions made by Dr. Cottrell and the engineers of the companies controlling the process.

The generators, which serve to furnish the low tension alternating current required by the transformers, are for operation on single-phase, 60-cycle circuits and are of the four pole, adjustable voltage type. Three sizes are supplied, having capacities of 15, 25 and 75 k.v.a. respectively. The generators are wound for a maximum voltage of 250 volts alternating current and are provided with fields for 125-volt direct current excitation. They are normally rated at 220 volts alternating current and will generate full rated current at voltages of from 110 to 250 volts. Field control of the voltage is obtained by means of a field rheostat of proper capacity for the range of voltages specified.

To drive the mechanical rectifiers when same are not driven by coupling to the generator shafts, small synchronous induction motors are furnished, in polyphase form only, for operation on 220 and 440 volts, 25 or 60 cycles.

The standard Cottrell transformers furnished are de-

Motor Generator Sets with Rectifier Direct Connected, showing Exciter Sets, Transformers and Switchboard



Typical Switchboard for Cottrell Units

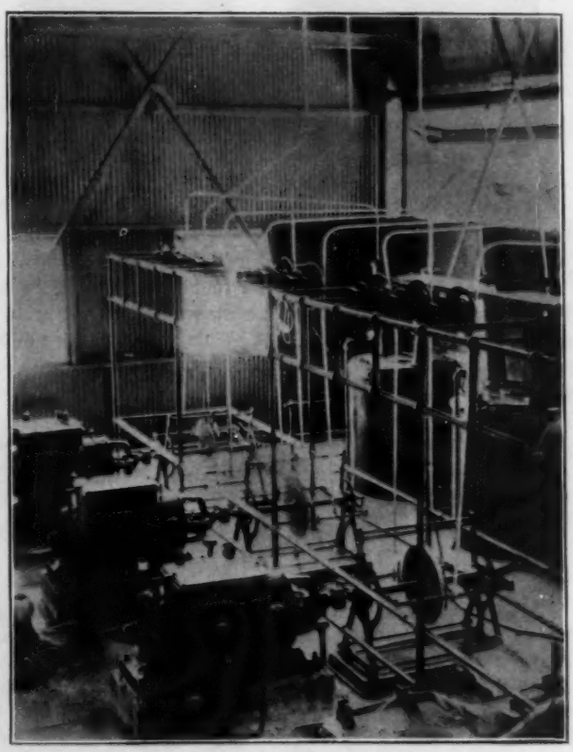
signed for use on 25 and 60-cycle circuits. For 25-cycle circuits the capacity of the transformers regularly furnished is 10 and 20 k.v.a.; for 60 cycles, 15 and 25 k.v.a The transformers are furnished with low tension for either 200, 220 or 440 volts, though 220 volts is considered standard. The standard high tension voltages are 100,000, 60,000, and 40,000 volts, maximum.

For high tension voltages of 50,000 volts and over the transformers are provided with condenser type terminals. All transformers for 40,000 volts and over have a small oil immersed choke coil mounted within the case between the end turns and the high tension terminals. Transformers for over 50,000 volts have, in addition, choke coils mounted one on each high tension terminal outside of the case. The transformers are mounted in substantial boiler iron cases with welded seams, and are provided with cast iron taps through which both high and low tension terminals are brought through suitable bushings.

As the value of the high tension direct current voltage at which the treater will give best results varies with the constituency, temperature and velocity of the gasses passing through it, as well as with the barometric condition of the surrounding atmosphere, it is necessary to vary and control the voltage supplied to the treaters. This is accomplished by varying the low tension voltage of the step-up transformer, either by impressing the low tension supply voltage on different taps in the low tension winding, for large variations, or by minor adjustments in the voltage supplied to the low tension winding of the transformer when the variation is small in range.

While the switchboard equipment for the control of Cottrell apparatus is usually built to meet the requirements of individual plants, certain control apparatus is embodied in all of it. In general, there are three different arrangements utilized, the switchboard equipment for each varying somewhat. The switchboards are arranged either for the control of motor-generators and transformer when each transformer is fed from its own generator; for the control of both motor-generator sets and transformers when several transformers are fed from one generator, or for the control of transformers fed from constant potential lighting or industrial circuits.

The source of low tension alternating current may be either a constant potential single-phase industrial or lighting circuit, or it may be furnished by a single-phase alternating current generator. The use of a constant potential industrial or lighting circuit for the transformers has an advantage in that it eliminates the cost and losses of a separate generator as well as the driving power for same, tending to reduce the total cost of the installation and to improve its efficiency slightly. However, the saving in both costs and the improvement of efficiency is not of great magnitude when compared with the total first cost and the operating cost of the complete treater. On the other hand, the use of a separate generator as a source of low tension supply, has several advantages, in that it eliminates from the treater operation any variation in the voltage of the supply circuit, frees the supply circuit from any disturbances in the treater, and somewhat simplifies the voltage control.



Motor Generator Sets with Starters, Direct Connected to Rectifiers, Transformers to Right

A FORCEFUL SALES PLAN TO POPULARIZE VACUUM CLEANERS

A timely and forceful sales plan has recently been introduced by the Hotpoint Electric Heating Company of Ontario, California, manufacturers of the Hotpoint Vacuum Cleaner, whereby the Hotpoint distributer is materially assisted in selling the cleaner on the installment plan.

A special form of coupon bond certificate is furnished the Hotpoint distributer with every cleaner purchased. The certificate is simply worded, and is in the form of a note, being a promise to pay, and is negotiable. To each certificate is attached a generous supply of coupons. Each coupon is blank, as far as the amount of payment and the time limit of the special offer is concerned, it being left to the discretion of the dealer to make his own terms.

Our correspondent writes that while similar plans have been used in marketing various forms of merchandise, the very forcefulness and timeliness of this plan is making it a success.

ELECTRIC DRIVE FOR BATTLESHIPS COLORADO AND WASHINGTON

Contracts totaling approximately $2,000,000, have been placed recently with the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., by the New York Shipbuilding Company, for furnishing the necessary electrical equipments for the propulsion of the new superdreadnaughts Colorado and Washington.

The equipments to be furnished are practically duplicates of that contracted for by the Navy Department for the U. S. S. Tennessee now building at the New York Navy Yard. The four propellers as in the case of the Tennessee, instead of being mechanically connected to driving engines or turbines, are to be driven by individual motors. The current for the motors will be furnished by two turbine generators.

THE STANDARDIZED MASTER CATALOG INDEX

In the six months since the Master Catalog idea was presented to the National Association of Purchasing Agents, buyers, salesmanagers and publishers have almost unanimously favored the plan as outlined.

The details of the most important parts of the master catalog remain to be developed to their fullest extent. For instance the index to this Master catalog must be standardized for two important reasons: Sales managers want their printed matter to secure for them the greatest possible benefits and therefore they must know exactly how to arrange and index their lines of goods to be sure that when the buyer refers to his catalog he will find their sheets or books. Buyers must be able to feel that, when they have looked in a certain definite place in their master catalog, they have there found all their available data. "One place for everything and everything in its place."

It remains for each industry to look after its own interests and to see that those who are most thoroughly familiar with its particular requirements, and who are best qualified to plan its section of the index are invited to co-operate in that work. Herein lies an opportunity for very effective construction work on the part of the various trade journals and associations for the general benefit of all the members of their industry.

Anyone desiring to co-operate in the development of Standard Master catalog should communicate with W. L. Chandler, assistant treasurer Dodge Sales & Engineering Company, Mishawaka, Indiana.

PROOF THAT ADVERTISING LOWERS SELLING COST

The rising cost of living is the great universal hardship of the present day. So great and so many have these rises been that few people stop to realize that there have been any exceptions to the general rule. But the fact is that there have been numerous exceptions and all of these exceptions belong to the same great class—that of nationally advertised goods.

The old idea that the cost of advertising raises prices dies hard. But the business man knows better. He knows that selling goods is costly business—no matter what the goods or what the selling methods. And he knows that anything which creates demand on a large scale, and thus makes selling easier, is bound to reduce selling costs and thus helps to reduce prices.

But evidence is better than argument; facts are better than theories. The Association of National Advertisers, an organization of 260 of the leading advertisers of the country, has been at great pains to collect the facts. It has secured an immense body of data from its members which proves that advertising does reduce selling costs and thus tends to reduce the selling price of advertised goods. A few representative cases will suffice.

The makers of a famous photographic camera, when they began advertising twenty-eight years ago, made one camera which took a 2½ inch picture and which sold at $25. Today they make a far better camera which sells for $10.

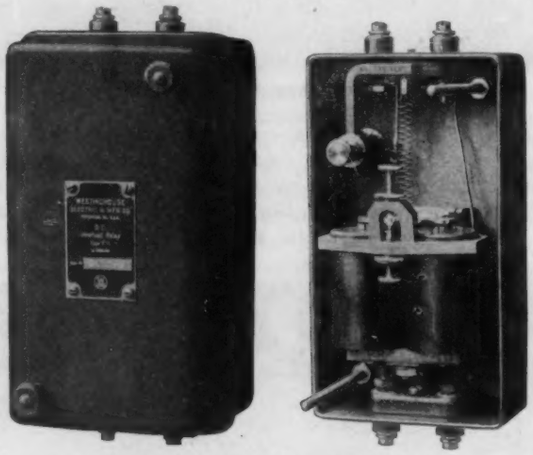
When the manufacturer of a famous breakfast food specialty began advertising, his goods sold at 15 cents a package. Today the package is fifty per cent larger and the price has been reduced to 10 cents.

Then take the most conspicuous example of them all—the automobile business; and compare the $5000 or $10,000 cars of ten years ago with the equally good cars of today, selling for a fraction of the money.

"A triumph of economical marketing" is the only possible verdict for advertising in the face of these facts.

WESTINGHOUSE DIRECT CURRENT OVERLOAD RELAY

The relay illustrated has been developed by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh Pa., to give overload protection on direct current circuits. It is particularly applicable for use in connection with three-wire generators having but four cables running to the switchboard, as by connecting the control coil of the relay to ammeter shunts the circuit breakers can be mounted on the switchboard, yet controlled by the actual armature current as required by the Fire Underwriters. Without the



A New Direct Current Overload Relay

relay the circuit breaker must be insertd in the circuit breakers can be mounted on the switchboard, yet controlled by the actual armature current as required by the Fire Unrelay the circuit breaker must be inserted in the circuit at the position of the ammeter shunt. This would require either that the circuit breaker be mounted at the generator, away from the switchboard, or that an extra pair of leads be run from the generator to the switchboard.

This relay is known as the type TO. The operating part is a two-pole electro-magnet with special winding. This, and an adjusting mechanism are enclosed in a dust proof case of aluminum alloy.

TRADE NOTES

William P. Bonbright & Company, incorporated, announce the removal of their offices to the Equitable Building, corner Nassau and Cedar streets, New York, April 9, 1917.

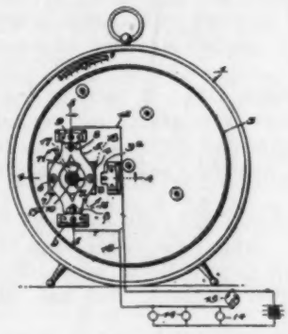
The Colorado Power Company has signed a new contract for an electro-metallurgical installation for a manufacturer of ferro-tungsten, providing for 600 kilowatts of use and producing a yearly gross income of about $25,000.

WHAT WESTERN INVENTORS ARE DOING

(The electric sign continues to be a profitable load builder for the central stations throughout the West. Inventors have in the past shown considerable ingenuity in perfecting electric advertising devices. In the following lines may be found a new invention for such a device, together with other descriptive briefs of inventions perfected by men throughout the West.—The Editor.)

1,221,216. **Time-Controlled Switch.** George R. Pyper, Midvale, Utah.

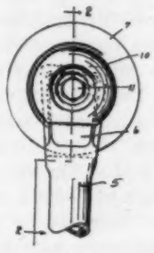
A manually set time-controlled rotary shaft, a circuit closing member mounted upon it to be limited to a number of movements, a trio of stops spaced on an arc described around the



shaft, and a hand key having a portion extending laterally from the shaft for contact with the stops, the key being pivoted to the shaft to allow it to be rocked manually in order to clear the intermediate stop.

1,221,763. **Trolley.** Joseph McMillan, Glendale, and Clarence V. Greenamyer, Los Angeles, Cal.

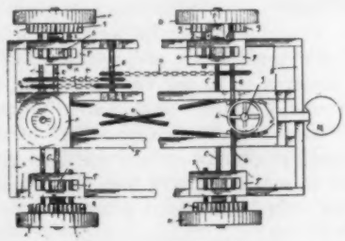
A trolley harp guard comprising plates secured upon the axle of the trolley wheel, the plates having the edges



curved to lie within and close to the flange of the trolley wheel and being chambered at the central portions to receive and protect the fastening means on the ends of the axle of the trolley wheel.

1,221,320. **Tractor.** Martin Hansen, Salt Lake City, Utah.

A self propelled vehicle the combination of four traction wheels; a stub axle for each wheel; an annular gear concentrically secured on each of the wheels; a wheel pivot for



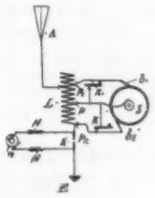
each of the gears; a frame mounted on the pivots; two reaches each of which is pivoted to the inner ends of one rear and one front axle; means to suspend the reaches from the frame and allow longitudinal movement thereof; a rack on the front portion of each of the reaches with the teeth turned inwardly; a gear whose teeth mesh with the teeth of the racks; and means to rotate the gear and thereby to have the axles on the pivots.

1,221,430. **Airship.** Alfred Extrand, Aberdeen, Wash.

An airship, a hull, a horizontal diaphragh extending longitudinally through the hull dividing it into upper and lower compartments, transverse partitions extending across the upper compartment to subdivide it into cells, means for filling the cells with a gas lighter than air, vertical longitudinal partitions extending along the lower compartment to form a

passageway, transverse partitions subdividing the lower compartment on opposite sides of the passage-way into state-rooms and air-chambers with each state-room communicating with an air-chamber, means for compressing air within the air chambers, and means for controlling the communication between each state-room and its respective air-chamber to regulate the flow of compressed air from the latter to the former.

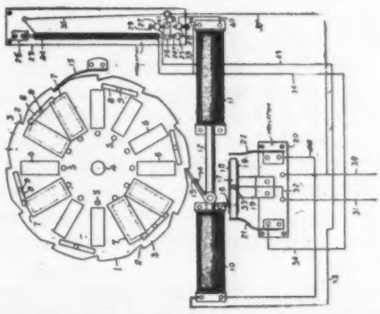
1,221,033. **Wireless-Telegraph Signaling System.** Lee de Forest, San Francisco, Cal., assignor to Radio Telephone & Telegraph Company, a Corporation of Delaware.



A system for multiplex wireless signaling, a radiating antenna system, key controlled circuits associated therewith, keys for controlling the circuits and means for automatically shunting the keys in succession.

1,219,933. **Electric Advertising Device.** William Cochran Gillespie, Phoenix, Ariz.

The combination with a rotatable disk, of means for intermittently rotating the disk, the means comprising a pair



of solenoids, a common core for the solenoids, means connected with the common core for rotating disk, and thermostatic means for controlling the solenoids.

NEW ELECTRICAL DEVELOPMENTS

(The most important new electrical development of the past semi-monthly interval is the beautiful and inspiring resolution adopted at the Riverside convention in which the representatives of a half billion of dollars in hydroelectric investments in California, Arizona, Nevada and New Mexico tendered to the government of the United States their all to assist in necessary transportation, manufacture of munitions of war, in shipbuilding, the raising of food stuffs and other necessaries of life. Other notations on new electrical developments throughout the West may be gleaned from the following pages.—The Editor.)

FINANCIAL

MEDFORD, ORE.—The Oregon Gas & Electric Company of Medford ran behind $11,458 last year, according to its annual report filed with the public service commission. Its operating revenues for the year were $37,592 and its operating expenses $45,242. Taxes came to $7650 and there were other deductions.

NEWBERG, ORE.—The Yamhill Electric Company of Newberg, according to its annual report filed with the public service commission at Salem, received a net income of $11,194. Its operating revenues amounted to $37,011 and its operating expenses were $23,870. It paid a 6 per cent dividend on $100,000 of common stock.

California-Oregon Power Company

(Operating in Yreka, Dunsmuir, Montague and vicinity, and in Oregon).

Total fixed capital	$16,293,082.44
Total assets	19,727,604.00
Capital stock	10,000,000.00
Reserves	349,330.46
Gross corporate income	106,220.50
Net corporate loss for year	183,204.56
Deficit on December 31, 1915	123,681.86
Deficit on December 31, 1916	365,386.31

Northern California Power Company

Income account for 1916:	
Operating revenue	$853,125.84
Operating expenses	371,702.34
Net operating revenue	481,423.50
Non-operating revenue	6,550.50
Gross corporate income	487,974.00
Non-op. revenue deductions	2,228.32
Interest accrued on funded debt	352,920.37
Miscellaneous deductions	4,603.18
Total deductions	359,751.87
Net corp. income for year	128,222.13
Miscellaneous additions to income	57,038.56
Miscellaneous deductions from income	188,375.15
Surplus on December 31, 1915	239,603.15
Surplus on December 31, 1916	236,488.69

ILLUMINATION

GREAT FALLS, MONT.—Proposals closed April 10 for constructing a complete street lighting system in S. I. D. No. 299.

PORTLAND, ORE.—City Commissioner Daly has added to his estimate for a municipal light plant $350,000 for an auxiliary steam plant.

LOS ANGELES, CAL.—The board of education has called for bids for installation of electric fixtures in the Jefferson High School.

VALLEJO, CAL.—The contract for municipal lighting for the coming year has been awarded to the Vallejo Electric Light & Power Company.

PALOUSE, WASH.—The Washington Water Power Company will rebuild the power plant under terms of 25-year franchise passed by the council.

OTHELLO, WASH.—The council decided to equip a municipally owned lighting plant, also to make extensive improvements to the water system; cost about $14,000.

LOS ANGELES, CAL.—The board of supervisors has accepted the bid of the city of Glendale for furnishing additional lights and supplying lighting current for the Verdugo Lighting District.

EUREKA, MONT.—The council passed an ordinance calling a special election to pass upon the matter of granting an electric light and power franchise to J. J. Tetrault et al. The proposed plant will cost about $60,000.

SANTA BARBARA, CAL.—A blanket franchise to permit the laying of gas pipe lines along every highway in the county outside of incorporated cities has been applied for by the Midland Counties Public Service Corporation.

SANTA BARBARA, CAL.—The Midland Counties Public Service Corporation has applied for a franchise to lay and for a period of 50 years to maintain a system of gas pipe under and along public roads and highways in Santa Barbara County.

LOS ANGELES, CAL.—A petition has been filed with the board of supervisors asking for the establishment of a highway lighting district to be known as Jefferson Lighting District of Los Angeles County. A hearing will be held April 30.

BAKERSFIELD, CAL.—The franchise for laying a pipe line to distribute natural gas in the town of McKittrick was sold by the Kern County Board of Supervisors to the Producers' Gas & Fuel Company. The gas will be piped from the Midway.

GREENVILLE, CAL.—The Pacific Gas & Electric Company will soon extend its electric line three miles farther out the Stockton road to Greenville, having secured the signatures of 25 subscribers along the way who desire light or power service.

LOS ANGELES, CAL.—The board of supervisors has granted to the Los Angeles Gas & Electric Corporation, a franchise to lay, construct and maintain certain gas pipes, in, under and along certain public roads and highways in Los Angeles County.

SEATTLE, WASH.—City Architect Daniel Huntington has completed plans for the construction of a one-story addition to the auxiliary steam power plant on Eastlake and Nelson Place; cost is to be between $75,000 and $80,000, by day labor. Bids will be called at once for driving 6000 ft. of piles for the foundation.

SANTA MONICA, CAL.—The city council has ordered the improvement of a portion of Second street between Utah avenue and Santa Monica boulevard by the installation of ornamental cast iron lighting posts with all wires, pipes, conduits, lamps, necessary for street lighting.

ARCADIA, CAL.—The board of trustees has awarded the contract for improvement of a portion of First avenue, to the Southern California Edison Company, on its bid of $1400 for installation of 29 reinforced concrete ornamental street lighting standards together with wires, pipes, conduits, globes, lamps and all accessory fixtures.

LODI, CAL.—The Sacramento Natural Gas Company has submitted to the board of city trustees a written offer for the sale of its plant to the city, which Manager C. H. Keyes said would be done following the agitation for a municipal system. The offer makes two propositions, one of $74,874.12 which Keyes declares is 20 per cent less than its cost or to fix a price through a board of arbitration, consisting of two engineers, one named by the city and the other by the gas company. If these engineers cannot reach an agreement they will be allowed to call in a third and the company will take 10 per cent less than the amount fixed.

TRANSPORTATION

SAN FRANCISCO, CAL.—The Supervisors unanimously adopted the resolution appropriating $116,000 of the Municipal Railway funds for the building of additional tracks on Market street line with the Van Ness avenue tracks.

SAN DIEGO, CAL.—The San Diego Electric Railway Company proposes to connect its University Heights lines and its Mission Hills line by constructing a cut-off between First and Washington streets and Fifth and University avenue.

TACOMA, WASH.—Superintendent J. F. Richards of the C., M. & St. P. railway says that the substation to be used in connection with the electrification of the Tacoma terminals will be 85 or 90 ft. by 60 to 75 ft. and will cost $175,000. It will eb located on the Tacoma tideflats.

JACKSONVILLE, ORE.—An ordinance has been passed by the city council granting to the Southern Oregon Traction Company a franchise for the construction, operation, use and maintaining of a railway along certain streets and highways in the corporate limits of the city of Jacksonville, Oregon.

BIG PINE, CAL.—A survey has been completed for an electric railroad and power line from Olanch on the broad gauge railroad to the property of the Darwin Lead & Silver Mines & Development Corporation at Darwin. It is the intention of the company to proceed with building of this road and power line this fall.

KLAMATH FALLS, ORE.—A resolution has been passed by the city council calling for bids for the construction of the Klamath Falls Municipal Railway. The road will extend from Second street and Klamath avenue, in this city, to a point near Dairy Station, 20 miles east, and will form a link in the Oregon, California and Eastern Railroad.

BISHOP, CAL.—Following its purchase of the Defiance, Independence and other mines of the Darwin District, the Darwin Development Company announces that it will at once begin the construction of an electric railroad along the south shore of Owens Lake to connect with the Southern Pacific standard track at Olancha. The distance is 23 miles.

GLOBE, ARIZONA.—The Globe-Miami Electric Railway Company has been incorporated here with Harvey T. Lynch, president of the company; J. J. Mackey, vice-president; Edgar Sultan, secretary-treasurer and Frank J. Dains, general manager. The company will build an electric railway from Globe to Miami. Engineers to survey the route have been engaged and will commence operations shortly. It is expected that the first rails will be laid within 60 days.

TRANSMISSION

ALHAMBRA, CAL.—The Pacific Electric Railway Company will erect a substation here, the work to begin in a short time.

FOLSOM, CAL.—The Pacific Gas & Electric Company has completed plans for reconstructing its entire system in Folsom.

LOS ANGELES, CAL.—It has been announced that it is intended to submit a proposed $12,000,000 power bond issue to the people at the coming general election to be held June 5th.

SEATTLE, WASH.—Bids will be received soon for the generating station of the proposed $3,000,000 hydroelectric plant, plans having been approved by the board of public works.

LIVINGSTON, MONT.—Question of installing a better street lighting system has been taken up by the council with the Montana Power Company. Definite action is expected very shortly.

GLASGOW, MONT.—The Knight Electric Company of Glasgow, has been awarded the contract for furnishing and installing the Oswego electric plant by the county commissioners. Cost, $2700.

SHELTON, WASH.—Irene Richardson, auditor of Mason County, reports the Mason County Power Company has filed an application for a franchise to erect transmission lines throughout Mason County.

BAKER CITY, ORE.—The county court yesterday granted a franchise to the Baker Mines Company to construct a power line from Halfway to Cornucopia for the purpose of furnishing power for the operation of the mine.

LOS ANGELES, CAL.—The city of Los Angeles has filed with the state water commission three applications asking permission to appropriate waters at three different points for the purpose of generating electric power.

TOUCHET, WASH.—The Pacific Power & Light Company will erect a transmission line 16 miles to this town this spring. The power plant on Priest River will be tapped and a substation erected. About 18 miles of wiring will be strung in Touchet.

RED BLUFF, CAL.—The Northern California Power Company has purchased the V. B. Taylor power plant and water rights located on 80 acres of land near Manton. The power company will improve and extend the producing powers of the plant.

TWIN FALLS, IDAHO.—A proposition to put Blue Lakes into the city with Clear Lakes power, at the same time to furnish power for electrical light and power to the municipality for a total sum not to exceed $830,000, is the plan of George W. Sturtevant.

PASCO, WASH.—The Franklin county commissioners have granted a 50 year franchise to the Pacific Power & Light Company to construct electric transmission lines throughout Franklin County, it is presumed, with the Washington Water Power Company line at Lind.

OXNARD, CAL.—The Ventura County Power Company is placing a line of new poles in the alley running between Fifth and Sixth streets to prepare for the removing of the poles on Fifth street. This work is but part of a general program of improvement. The entire system in the city is being put in first class condition.

SEATTLE, WASH.—Work will be started some time this week on the construction of a one-story addition to the auxiliary steam power plant for the city on Eastlake avenue and Nelson place at a cost of between $75,000 and $80,000. Work will be done by day labor. The building will be 80 by 89 ft. of reinforced construction.

OROVILLE, CAL.—Officials of the Pacific Gas & Electric Company have announced that within the next two weeks they will start reconstruction on a larger scale of their plant at the foot of Huntoon street. The company, within another month, also will start tearing down its lighting system in the business district, replacing the present arcs with those of more modern design.

WALLA WALLA, WASH.—The city of Touchet is to be supplied with electricity this spring according to an announcement made by Manager C. S. Walters of the Pacific Power & Light Company. Electricity will be obtained by tapping the big power line from the Priest Rapids plant to this city. A substation will be constructed in Touchet and will be equipped with a 66,000-6,600 step-down transformer.

SEATTLE, WASH.—The Stone & Webster Corporation, will start work this summer on its $1,000,000 electrical power plant on the Baker River for the electrification of the Great Northern Railway, or the Chicago, Milwaukee Railway, between Seattle and Bellingham, Wash. Frank Walsh, assistant superintendent of the company, states that construction offices have been opened in the Electric Building where an engineering force is being secured.

OROVILLE, CAL.—The Pacific Gas & Electric Company announced that the old substation on the Marysville road, which was destroyed by fire two years ago, would be rebuilt and put into service again by the company. Other important rebuilding work is being done or contemplated by the company for the near future and Manager Ed. Johnson is starting in to keep his promise and to give Oroville a fine light and water service.

SALEM, ORE.—A power plant which will cost $200,000 is proposed for Harney County, about 75 miles south of Burns, according to an application for a permit filed in the office of the state engineer. The application was filed by Scott

Catterson, who seeks to appropriate 40 second feet of water from the Donner and Blitzen River for the development of 2171 horsepower. It will be necessary, according to the plans, to construct a canal and pipe line nine miles long and construct a concrete dam 60 ft. in length.

TACOMA, WASH.—It has been announced that a substation will be built near the Tacoma shops of the Milwaukee Railway Company for the operation of the Milwaukee railway lines west of the Cascades. The cost of the shops will be $175,000. Power for the main line operation will be furnished by the Puget Sound Traction, Light & Power Company and will be generated from the Snoqualmie Falls plant. The $175,000 cost includes the erection of substations at Taunton, Doris, Kittitas, Cle Elum, Hyak, etc.

LOS ANGELES, CAL.—The Southern California Edison Company has applied to the California Water Commission for the right to appropriate water from the North Fork of the Kern River and from Salmon Creek in Tulare County for the generation of electric power. These water rights were acquired by the California Power Company in 1901 and 1902 and since that time Southern California Edison has expended $881,104 in their development. The cost of the proposed new deevlopment is given as $4,118,205. The new development will be Kern River plant No. 3 and will involve a diversion dam 60 ft. high and 240 ft. long, of steel and concrete construction. Power will be developed by two turbines directly connected to generators of 15,000 kilowatts each, giving the new plant 30,000 kilowatts' initial capacity. The total fall to be utilized is 800 ft. and the amount of available power development is in excess of 54,000 horsepower. The new plant is to supplement existing plants of the company to meet the increased demand for electric current for light and power, and the company asks that it be given until July 1, 1922 to complete the work of construction.

TELEPHONE AND TELEGRAPH

FLAGSTAFF, ARIZ.—A private telephone line is to be installed here with connection with Prescott for the use of the Arizona Lumber & Timber Company.

OXNARD, CAL.—Rights of way are being secured by the Pacific Telephone & Telegraph Company for a new line the company is building from Los Angeles to El Rio.

WAPATO, WASH.—The city council has granted the Pacific Power & Light Company a franchise to furnish light and power to the town for a period of 50 years.

YUMA, ARIZ.—At a meeting of the board of governors of the Yuma County Water Users' Association, a resolution was passed having for its object the installation of an independent telephone exchange among unit holders of the valley.

HONOLULU, T. H.—Permanent improvements to cost $150,000 are being planned by the Mutual Telephone Company for 1917. They are an extension to the main plant on Adam's Lane and the installation of an automatic exchange in Kalihi, between $15,000 and $20,000 will be spent on the main building.

BENSON, ARIZ.—A telephone construction gang under the supervision of O. C. Joy is building a line between Benson and Bisbee via Fairbank. Besides the new Bisbee line there will be another extending from Fairbank into Tombstone and a branch line etxending into Huachuca and Hereford from a point about midway between Fairbank and Bisbee.

IRRIGATION

LOS ANGELES, CAL.—Lester H. Baxter of Independence has applied to the State Water Commission for permission to appropriate water of springs in Inyo County for the irrigation of 80 acres of land.

LOS ANGELES, CAL.—The Cardiff Irrigation District of Cardiff, San Diego County has applied for the use of one cubic foot average flow of Escondido Creek at Olivenhain for domestic and irrigation use. The water is to be obtained from three wells, 8 in. in diameter and from 56 to 61 ft. deep. To convey the water there is proposed a 22.418 ft. of 12 in. pipe, 3619 ft. of 8 in. pipe. The estimated cost, $84,200, and water to be used on tract of 825 acres.

ANDERSON VALLEY, CAL.—If all the plans of the directors of the Anderson-Cottonwood Irrigation District are carried out, there will be water running in the main canal of the irrigation system some time between June 15 and July 1. The completion of the construction of the system will be started within the next two weeks. There is more than enough land signed up, over $700,000, to call the election for a bond issue of $575,000.

LOS ANGELES, CAL.—J. G. Ruddle of Snelling has applied to the State Water Commission for permission to appropriate 20 cubic feet per second of the waters of Merced River in that county for irrigation purposes by a diverting dam the full width of the river. The applicant proposes to carry the water into a canal 6½ miles long. Two 12 in. pumps will lift the water 56 ft. to a point from which it will be carried by gravity, except in a few places where small auxiliary pumping plants will be used. It is intended to irrigate 1960 acres, the estimated cost being $10,000.

OAKDALE, CAL.—Three different storage propositions are being put into shape to be presented to the voters of the Oakdale Irrigation District. The Sierra and San Francisco Power Company offered to sell storage water for $1 per acre foot. J. H. Cameron and A. Roleri propose to dam the Stanislaus River near Copperopolis. The proposal is for a company to build the dam and sell it to the district taking bonds in payment. The third proposition is for the Utica Mining Company to build a reservoir at Spicers Meadow. This plan was previously held up.

SACRAMENTO, CAL.—The application to the Water Commission filed by W. E. Boone of Berkeley, who, it is understood, represents some of the principal irrigation corporations of the district, is planned to reorganize the entire territory under the name of the Kings River Conservation District, and to install an immense reservoir, as well as a number of dams and channels, at a cost of more than $9,500,000. Should the project go through, it will mean water for an area four times as great as is any under government reclamation system at this time. The plan calls for the damming of Kings River with a structure, plans for which have already been drawn. In addition to the construction of the reservoir, the development of the underground water supply is also contemplated.

ANDERSON, CAL.—Work on the completion of the Anderson-Cottonwood Irrigation project will proceed with a rapidity that will insure water to two-thirds of the district by the middle of summer. It has been decided to flume across Spring Gulch instead of completing the cut. It is estimated the completion of this work would require $25,000, whereas the flume it is declared will not cost over $18,000. A siphon across the Sacramento River to Churn Creek undoubtedly will be done away with provided the district can sell 110 tons of pipe it has on hand for this work. It is the intention of the engineers to bridge this crossing. The bridge will be of suspension character. Some $50,000 has been advanced the district by financial interests in San Francisco pending a bond election to be held this month.

LINDSAY, CAL.—The collective system of the Lindsay, Strathmore Irrigation ditch is 90 per cent completed, according to a statement of S. E. Keifer, engineer of the project. Twenty wells ranging in depth from 90 to 204 ft. have been completed, and with these the water supply will be sufficient to fill the ditches. At the end of the flume the water will be conveyed to the Strathmore district by means of a 36-inch pipe, and to El Mirador reservoir by means of a 30-inch pipe. From El Mirador reservoir the water will also be pumped to another high line ditch, which will supply a large acreage. The system requires the need of three power plants with a combined power of 3650 horsepower.